CONSEIL FRANÇAIS DE L'ÉNERGIE
WORLD ENERGY COUNCIL

22ème Congrès Mondial de l'Énergie à Daegu

Incertitudes et résiliences

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CONSEIL FRANÇAIS DE L'ÉNERGIE
COMITÉ FRANÇAIS DU CONSEIL MONDIAL DE L'ÉNERGIE

Securing Tomorrow's Energy Today

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Administrateurs du Conseil Français de l'Énergie

22ème Congrès Mondial de l'Énergie à Daegu
Incertitudes et résiliences

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Avant-propos

Le 22ème Congrès Mondial de l'Énergie s'est tenu à Daegu, en Corée du Sud, du 13 au 17 octobre 2013 pour « préparer aujourd'hui l'énergie de demain » : il restera comme un « grand cru » des congrès organisés tous les trois ans par le Conseil Mondial de l'Énergie.
Au-delà de l'importance de la participation, de la notoriété des orateurs, de la qualité des débats et de l'accueil de nos hôtes coréens, c'est la dynamique de la réflexion qui semble en faire un congrès exceptionnel.

Le congrès s'est ouvert dans un contexte d'incertitudes présent dans la plupart des études publiées par le Conseil Mondial de l'Énergie [1] : tel est le cas des scénarios mondiaux de l'énergie à l'horizon 2050, Jazz et Symphonie, dont la « mise en musique » met en évidence la difficulté à équilibrer le « trilemme énergétique » : sécurité énergétique, équité énergétique et respect de l'environnement. Ces incertitudes se retrouvent aussi dans la représentation des enjeux énergétiques mondiaux, présentés pour la France en juillet à Paris (voir publication *« Les enjeux énergétiques mondiaux vus par les acteurs français »*) et pour le monde lors du congrès. On a retrouvé dans les thèmes des sessions du congrès les incertitudes liées aux risques et aux vulnérabilités énergétiques, aux politiques énergétiques et climatiques, à la prospective technologique et à la géopolitique.

Le congrès, lieu d'échanges et de brassage d'idées entre délégués venus du monde entier, a particulièrement mis en évidence la dimension géoéconomique. Organisé pour la seconde fois en Asie, l'importance des pays de cette région était forte et permanente. Mais, à côté des dynamiques, bien identifiées, de la Chine ou de l'Inde, c'est la dynamique du continent tout entier qui était très perceptible : Corée, bien sûr, et Japon mais aussi Asie du Sud-Est, avec des pays moins connus comme l'Indonésie ou la Malaisie. Poursuivant le tour du monde, on traverse l'Afrique et l'Amérique latine, continents en ébullition et dont le poids énergétique s'affirme, pour arriver en Amérique du Nord, peut-être tentée de se replier sur elle-même, forte de nouveaux eldorados énergétiques qui lui apportent au moins pour quelque temps plus de croissance et de prospérité. Il ne nous reste qu'à revenir vers l'Europe qui veut être le bon élève de la classe, souvent donneur de leçons, mais qui n'a peut-être plus les moyens de ses ambitions. Pendant le congrès, le vieux continent est parfois apparu englué dans des problématiques peu partagées ; il ne semble pas avoir complètement intégré le changement de la « carte énergétique » mondiale.

Le congrès a conforté, on l'a dit, les incertitudes d'aujourd'hui. Les constats peuvent sembler pessimistes et ils se sont concrétisés dans la déclaration du congrès par la dénonciation des « mythes » qui risquent de brouiller nos choix pour demain.

[1] Les études du Conseil Mondial de l'Énergie publiées à Daegu
- World Energy Scenarios
- World Energy Resources
- World Energy Trilemma
- World Energy Issues Monitor
- World Energy Perspectives

sont accessibles, avec pour la plupart un résumé en français, sur le site du Conseil Français de l'Énergie **www.wec-france.org**

Les débats et les études publiées par le Conseil Mondial de l'Énergie ont cependant conclu sur une vision plus confiante de notre futur énergétique, fondée sur la résilience du système énergétique mondial dans son acception la plus large. La compréhension des dynamiques de l'offre ou de la demande d'énergie, l'apport des technologies ou la modification des comportements, la définition et la mise en œuvre de meilleures politiques énergétiques ou climatiques, ou encore l'évolution des rôles des citoyens, des gouvernements et des industriels, sont autant de sujets majeurs évoqués durant le congrès mais c'est sur la capacité à sortir des impasses et à repartir sur de nouvelles voies de développement énergétique durable que s'est conclu le congrès. Avec toutefois un avertissement sévère sur l'urgence à agir, en « regardant au bon endroit ».

C'est donc l'heure de vérité. Le 23ème Congrès Mondial de l'Énergie, en 2016 à Istanbul, sera l'occasion de vérifier que nous avons su faire face en mettant en place les actions urgentes et fortes pour développer et transformer le système énergétique mondial. En publiant les temps forts du congrès – déclarations, résumés d'études, interventions, articles – le Conseil Français de l'Énergie souhaite contribuer au débat énergétique en le replaçant dans un cadre résolument international.

Bonne lecture,

Jean Eudes Moncomble
Secrétaire général
Conseil Français de l'Énergie

Congress statements and publications

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Official Congress statement of the World Energy Council

Exposing the myths, defining the future – it's time to get real to secure tomorrow's energy today

Complexity and uncertainty are increasing at an accelerating rate and energy leaders in both the public and private sectors need to make inspired decisions. Action is needed now.
We have found through our multi-year in-depth studies and issues-mapping with energy leaders that we are in a much more challenging world than previously envisaged.

The WEC's analysis has exposed a number of myths which influence our understanding of important aspects of the global energy landscape. If not challenged, these misconceptions will lead us down a path of complacency and missed opportunities.

Much has, and still is, being done to secure our energy future, but the WEC's studies reveal that current pathways fall short of delivering on the global aspirations of energy access, energy security, and environmental sustainability.
Energy leaders in both the public and private sectors agree on many of the actions necessary, but significantly are not aligned on the nature, value and importance of political and institutional risks and their critical impact on investment.

If we are to derive the full economic and social benefits from energy resources, then we must take incisive and urgent action to modify our approach to energy solutions. The usual business approaches are not effective. The focus has moved from large universal solutions to an appreciation of regional and national contexts and sharply differentiated consumer expectations.

Faced with an ever-changing kaleidoscope of issues, we have to embrace this new reality and define enhanced norms of performance and agility.
It's "Time to get Real" in defining our future.

Challenging the myths

Myth 1: Global energy demand will flatten out.

The Reality: Energy demand will continue to increase and double by 2050, primarily driven by economic growth in non-OECD countries.

Myth 2: Peak Oil - there is an imminent shortage of fossil fuel resources.

The Reality: There is no shortage in sight. The continued discovery of new resources and the emergence of new technologies that both enable the release of unconventional oil and gas and improve the recovery rates from existing fields have already multiplied the available fossil fuel reserves by a factor of four, and this trend will continue.

Myth 3: Demand growth will be fully met by the new clean energy sources.

The Reality: WEC analysis in the World Energy Scenarios shows that despite significant growth in the relative contribution of renewables from 15% today to a figure between 20% and 30% in 2050, in absolute terms the volume of fossil fuels used to meet global energy demand will be 16,000 MTOE in the Jazz (the more consumer-driven scenario) and 10,000 MTOE in Symphony (the more voter-driven scenario), compared to 10,400 MTOE in 2010. This represents a 5% decrease in the absolute amount of fossil fuels in Symphony but a 55% increase in Jazz.

Myth 4: We can reduce global GHG emissions by 50% by 2050.

The Reality: According to the WEC's World Energy Scenarios, even in the best case we will see a near doubling of global greenhouse gas (GHG) emissions by 2050, compared to where we should be in 2050 to meet the 450 parts per million CO_2 reference adopted by many. At worst GHG emissions could increase by over four-fold.

Myth 5: Current business models and markets are delivering.

The Reality: WEC analysis shows that energy markets are become increasingly complex, driven by accelerated change in energy policy, technological innovation, and consumer expectations. Current market designs and business models are unable to cope with the increasing renewable shares, decentralised systems, or growing information architecture.

Myth 6: Current programmes will deliver universal access to energy within the next 10 to 15 years.

The Reality: Universal access is far from becoming a reality. While acknowledging recent progress and current programmes to reduce energy poverty, the WEC's analysis shows that on current paths, between 730 million and 880 million people for Jazz and Symphony respectively will still be without access to electricity in 2030 and between 320 million and 530 million people in 2050 globally.

Myth 7: On a global scale capital is cheap and abundant.

The Reality: Capital is extremely sensitive to perceived political and regulatory risks. Moreover, due to the growing pressures on public finances in most countries, public funds will not be available to substitute or augment the private financing of energy initiatives.

Defining the future

1. We are looking in the wrong place. The focus of current thinking about the energy system is biased and inadequate:

If we want to get the greatest social and economic benefits out of our energy systems, the focus must shift from the supply mix to demand efficiency. We need more demand-side investments, innovation, incentives and stronger technical standards to reduce energy intensity. Price controls, subsidies, trade barriers and absolute targets for individual technologies distort the market and can have unintended consequences, so policymakers must use them only sparingly.

2. In order to attract the needed investment national policy and regulatory frameworks have to be balanced:

We need robust, predictable and transparent frameworks that allow the market freedom to exercise informed choices in terms of innovation, technology and investment. The "Energy Trilemma" provides a solid framework for every country to assess its own political risk and work towards balanced, predictable and stable policy and institutional frameworks. The WEC's analysis reveals that there is little agreement between investors and governments on nature, price, and value of risks. It is therefore critical to improve the understanding of the nature of risk and the way to price it. In the absence of such understanding, investment will not flow.

3. We need significant investments in RD&D:

We urgently need to realise the potential of breakthrough technologies such as electricity storage and CC(U)S. WEC analysis shows that the 450 parts per million CO_2 goal cannot be achieved without CC(U)S. It is essential, therefore, that there are clear and unambiguous policy and institutional frameworks to support investment in this technology to justify its inclusion in roadmaps and carbon emission reduction strategies.

4. The energy map is changing and our institutions need to change to keep pace with developments:

The centre of gravity in energy has moved outside OECD countries – and so are interactions between the countries and regions. In addition, consumer groupings and civil society expect to influence our energy future. Existing multilateral and plurilateral energy institutions need to reflect these changes, be more inclusive and responsive, or risk becoming obsolete.

5. To ensure universal access to energy, policy and institutional frameworks and funds are urgently needed to de-risk and support entrepreneurial approaches:

WEC recognises the need for urgent additional action and supports the objectives of the UN Secretary General's Sustainable Energy for All initiative. WEC further supports the inclusion of universal energy access as a key and distinct element in the post 2015 Millennium Development Goals. Supporting mechanisms and suitable funding are essential in order to achieve this goal.

6. It's no longer just about mitigation:

Risks from the energy-water nexus, extreme weather events, or cyber terrorism (to name but a few) expose our energy infrastructure to potential disasters. We need to urgently adapt, re-think, and redefine the resilience for energy infrastructure.

Future Energy Leaders' Programme

The FEL Vision:

"True leadership is the belief that you can't solve problems using the same thinking that created them in the first place."

This quote, from Albert Einstein, who attended the World Energy Congress in 1930, calls for fresh thinking, innovation and a new approach to problem solving. This means, fundamentally, change and transformation in the way we think – and we, the World Energy Council's community of Future Energy Leaders, are here to embrace it.

The Future Energy Leaders' Programme was initiated by the World Energy Council to encourage cross-border and intercultural networking of young energy professionals. Since its inception the FEL Programme has provided an opportunity for the next generation to grow and develop leadership qualities.

Through this experience we have been exposed to high quality content, listened to a broad range of perspectives, networked with global leaders and decision makers as well as worked with peers from all over the world.

The World Energy Council recognises the importance of this opportunity for us to develop. It also recognises the need to grow and nurture fresh talent as a sustained community, enabling us to contribute our optimism, enthusiasm and new ideas to the WEC network. This year's Future Energy Leaders have committed to a three year term with WEC. We will be the voice of the next generation of energy leaders until the next Congress in Istanbul in 2016.

Together, we have worked to define the FEL outlook. In the months leading up to the Congress - and throughout this week – we have focused our efforts and identified three themes that encapsulate our vision for the future. We would like to share this vision with you now.

► Embrace the change

The only certain thing certain about life is uncertainty. During the time we have spent together in this programme we have come to realise that in uncertainty there are many opportunities.

Change always comes much faster than we imagine – just look at what is happening with shale gas in North America. We see a future where these possibilities are everywhere. We have made a choice to embrace this change and we are aware of the consequences. We are confident in humanity's ability to innovate solutions that will balance the energy trilemma – ensuring that we have the energy we need, that it reaches those who need it most, and that it respects the boundaries of the planet that we live in.

This is our perspective; it is this self-fulfilling prophecy that empowers us. We look at the future and see this as our only choice.

► Let's add songs to the playlist

We recognise and appreciate the work that has gone into developing the 'Jazz' and 'Symphony' scenarios. But we need to be sure that when decisions are made these scenarios are not taken too literally.

Since you have picked music as the analogy, we hope you are prepared to recognise its diversity and creativity. We like to listen to jazz and to symphonies, but we also like rock, pop, and some of us like Gangnam Style. The playlist we need must recognise the inherent diversity of the world and incorporate multiple approaches, policies and technologies.

In other words, there are no "one size fits all" solutions. The ability to adapt and effectively recognise appropriate solutions for each region is essential.

► Make the most out of it

The only way for us to make our systems truly efficient is by redefining our concept of resources. We need to understand that resources are not simply the fuels sitting underground, technical knowledge or financial capital. We can also access energy from new business models, consumer behaviour, community engagement and knowledge transfer.

To achieve this efficiency across all dimensions, we must break down regional boundaries and redefine energy security. The traditional links between energy security and natural resources must change and the connections with people, food and water cannot be ignored.

This is already known and understood. What we need now is to turn our awareness and our enthusiasm into action. It may require changing our government structures, investment strategies or the way we cooperate, but, if this is what it takes, then this is what we are prepared to do.

By taking these concepts into account we believe that we can foster the transformation required to answer the challenges facing the energy sector.

The Future Energy Leaders commit to promoting these goals during the period leading up to the 2016 Congress in Istanbul, Turkey. We also commit to sustain the FEL programme and FEL network.

We would like to thank the World Energy Council for giving us this opportunity to grow professionally in this unique and truly global setting. We hope that the World Energy Council will join us in delivering these key messages and include these in its flagship programmes.

Finally, we would like to convey our sincere gratitude to our hosts the Daegu Organising Committee of the 2013 World Energy Congress.

"Kam sa ham nida."

Parole aux jeunes français

Tout comme il l'avait fait en 2010 à Montréal, le Conseil Français de l'Énergie a favorisé la participation de jeunes au congrès ; trois jeunes chercheurs français ont pu ainsi participer au congrès. Le CFE a voulu donner la parole à ces jeunes ; ils ont rédigé le rapport suivant sur leur premier Congrès Mondial de l'Énergie. Leur parole est libre, le CFE n'a joué qu'un rôle de facilitateur en organisant quelques échanges.

Du 13 au 17 octobre 2013, à Daegu, en Corée du Sud, près de 7 000 professionnels du monde de l'énergie se sont réunis pour échanger sur le thème « préparer aujourd'hui l'énergie de demain ». Parmi ces participants, trois jeunes professionnels français ont participé au congrès dans le cadre du programme « Future Energy Leaders » :

Laetitia de Maack. Ingénieur, Docteur en économie de l'énergie

Diplômée d'AgroParisTech, de l'IFP School et de l'Université de Montpellier 1, Laetitia de Maack a effectué sa thèse à l'IFPEN sur l'analyse économique des stratégies des pays producteurs de pétrole dans le raffinage.

Bianka Shoai Tehrani, Ingénieur, Doctorante en économie de l'énergie

Diplômée de l'Ecole Centrale Paris, Bianka Shoai Tehrani est en doctorat au CEA, à l'I-tésé (Institut de Technico-Economie des Systèmes Energétiques) sur l'étude des choix d'investissements sur le marché électrique européen, dans la perspective d'évaluer le potentiel de pénétration du marché des futurs réacteurs nucléaires.

Michel Berthélémy, Docteur en économie de l'énergie

Diplômé de l'Université Panthéon-Sorbonne et du master EDDEE d'AgroParisTech, Michel Berthélémy a effectué sa thèse à l'Ecole des Mines, au CERNA, sur l'économie du nucléaire et notamment sur les impacts de l'innovation et de l'organisation industrielle sur le secteur nucléaire.

Nous partageons ici nos impressions sur cette expérience avec vous et adressons nos remerciements au Conseil Français de l'Énergie de nous avoir permis de vivre cette expérience !

Un mot sur le 22ème Congrès Mondial de l'Énergie : « Préparer aujourd'hui l'énergie de demain »

Notre monde a soif d'énergie. Les pays en voie de développement ont un besoin urgent de répondre à leur demande croissante, et ce de manière durable, tandis que les pays développés sont en quête d'une sécurité énergétique de long terme. L'une des conclusions du Congrès Mondial de l'Énergie 2013 est particulièrement révélatrice des obstacles à surmonter : les technologies adaptées à ces besoins existent, mais ce sont les méthodes de financements et les business models innovants qui font défaut pour rendre la transition réelle.

S'appuyant sur les publications récentes du CME tels les *Scénarios Mondiaux de l'Énergie à l'horizon 2050* ou le *Trilemme Énergétique Mondial* (disponibles ici : http://www.wec-france.org/Congres_Mondial_de_l'Energie_Daegu2013.html), les tables rondes et les discours du congrès ont été animés autour de quatre thèmes (programme officiel disponible ici http://daegu2013.kr/eng/program/program_overview14.jsp) :

- Visions et scénarios pour le futur
- Identifier les opportunités de développement économiques : les ressources et les technologies
- Le trilemme énergétique : les mesures à prendre pour pérenniser la prospérité
- Construire un futur énergétique durable

Les sessions plénières et les conférences FEL ont mis l'accent sur le fort potentiel des renouvelables : par exemple la Chine a annoncé l'intention d'être à plus de 50 % de solaire dans le mix en 2030. Un intérêt particulier a également été porté à la précarité énergétique, notamment dans le cas de l'Afrique, où il y aurait l'opportunité d'installer une nouvelle forme de marché de l'énergie, sans mailler le territoire par des réseaux – en s'inspirant de la téléphonie et du passage direct au portable qu'a connu l'Afrique, sautant l'étape du fixe.

L'aventure FEL

Le programme « Future Energy Leaders »

Le programme « Future Energy Leaders » (FEL) du 22ème Congrès Mondial de l'Energie a réuni une centaine de jeunes professionnels entre 25 et 35 ans, travaillant dans tous les secteurs de l'énergie : pétrole, gaz, nucléaire, renouvelables… Issus de 45 pays différents, ils ont été sélectionnés plusieurs mois en amont du congrès par leur pays de résidence. Ils se sont ensuite répartis, sous la houlette de la dynamique Ori Chandler, en dix groupes de travail, selon leurs compétences et leurs centres d'intérêt. A partir du mois de juillet, les FEL ont travaillé à distance pour nourrir une réflexion commune autour de chaque thème, encadrés dans chaque groupe par un FEL plus expérimenté, ayant participé au Programme FEL du congrès précédent, jouant le rôle de modérateur ; la semaine du congrès a été l'occasion de se rencontrer enfin, et de passer à la vitesse supérieure en tirant les conclusions de ces travaux préparatoires et en proposant des solutions innovantes aux problématiques abordées. Les moments forts de cette aventure riche en découvertes, échanges et apprentissages sont restitués dans les paragraphes qui suivent.

Une semaine intense

Les FEL se sont découverts mutuellement le 13 octobre, dans le cadre informel et convivial d'une sortie culturelle à Gyeongju, ville célèbre pour son héritage historique en Corée. Après la visite du temple de Bulguksa et de la grotte de Seogkuram, ils ont rejoint le centre de conférence à Daegu pour assister à la cérémonie d'ouverture, où est intervenu le Premier Ministre de Corée.

Le lundi 14 octobre, le programme FEL proprement a dit a débuté, suivant son emploi du temps bien particulier : le matin, à 8 heures, la journée commençait par une intervention courte de 45 minutes, appelée « Fire Starter », où un conférencier seul présentait son projet et débattait ensuite avec la salle.

Le « Fire Starter » était suivi par les sessions plénières du matin, puis par une table ronde d'experts réunis spécialement pour les FEL en fin de matinée. Les tables rondes comme les Fire Starter présentaient l'avantage de permettre un débat plus animé et plus informel que les sessions plénières. Les questions de l'audience pleuvaient et souvent, les sessions devaient se clore en laissant de nombreuses mains levées !

L'après-midi, les FEL se réunissaient par groupe de travail pour avancer sur leur sujet durant deux heures. Lors de la première session de travail, les FEL ont d'ailleurs eu l'honneur de recevoir la visite du maire de Daegu, venu leur souhaiter la bienvenue dans sa ville.

La journée se terminait avec les sessions plénières de fin d'après-midi. Le soir, les modérateurs des groupes de travail faisaient le point sur le travail de la journée avec l'aide d'un FEL de son groupe lors des « sessions éditoriales ».

Le dernier jour du programme FEL a donné lieu l'après-midi à une restitution entre FEL des productions des différents groupes ; le message global des FEL a ensuite été porté à l'ensemble des participants par trois d'entre eux lors la cérémonie de clôture en fin de journée.

Enfin, le programme FEL continue évidemment au-delà de la conférence de Daegu à travers, par exemple, des groupes de discussion FEL sur les réseaux sociaux ou la possibilité de participer aux groupes de travail du CME.

Les groupes de travail

Les dix groupes, dont les rapports sont disponibles sur le site du CME http://www.worldenergy.org/wec-network/future-energy-leaders ont travaillé sur les sujets suivants (liste détaillée sur http://www.daegu2013.kr/_upload/FEL_Working_Groups.pdf):

- L'énergie sans frontière : comment satisfaire les besoins des communautés les plus démunies
- Les mécanismes de financement pour le développement des projets énergétiques de petite et moyenne taille
- Trajectoires vers un futur à énergie intelligente
- Les nouvelles frontières pour le gaz et le pétrole : sommes-nous prêts à les voir se dessiner ? En avons-nous réellement besoin ?
- La géopolitique du pétrole et du gaz
- La planification énergétique mondiale : est-ce une nécessité ? à quoi devrait-elle ressembler ?
- Le rôle des carburants alternatifs : que nous réserve le futur ?
- La transition vers une énergie décarbonée : quelles sont les alternatives ?
- Eau et énergie : les projets qui réussissent grâce à l'acceptation sociale
- Quelles technologies pourraient changer radicalement le portefeuille énergétique d'ici 2050 ?

Nous, FEL français, avons participé à deux groupes de travail : Laetitia de Maack et Bianka Shoai Tehrani sur les mécanismes de financement des projets énergétiques de petite et moyenne taille, et Michel Berthélémy sur la géopolitique du pétrole et du gaz. Ces groupes ont été l'occasion d'échanges de connaissances importants et enrichissants, dans la mesure où, d'une part, le travail préparatoire en amont du congrès nous a rendus plus efficaces lors des séances au congrès, et d'autre part, nous étions confrontés à des profils et des expertises différentes des nôtres. En effet, si les FEL français étaient tous doctorants ou jeunes docteurs, d'autres FEL étaient consultants, ingénieurs, entrepreneurs ou aidant à l'entreprenariat dans des incubateurs, conseillers de politiques…

La restitution des travaux des différents groupes le jeudi après-midi a permis de rendre compte de cette diversité de connaissances comme de cultures professionnelles. Les états des lieux brossés sur les divers sujets étaient complets et édifiants, démontrant la complémentarité des expertises, l'efficacité et même parfois l'originalité de la mise en commun des compétences dans l'ensemble du groupe FEL. L'un des groupes – celui des carburants alternatifs – a même relevé le défi de tourner et monter un docu-fiction, qui a été diffusé en lieu de la présentation.

Les conférences FEL : quelques intervenants marquants

Les « Fire Starter » et les tables rondes nous ont offerts des conférences FEL de grande qualité, animées par des intervenants de haut niveau. Voici les trois intervenants les plus marquants de ces conférences.

Marie-José Nadeau, canadienne et nouvelle présidente élue du CME, nous a fait un discours inspiré et motivant sur la participation des FEL au CME, nous exhortant à développer notre réseau professionnel, à nous exprimer librement et à nous impliquer dans le réseau. Elle a affiché une volonté particulière de faire participer les jeunes et les femmes au réseau.

Jason Drew (AgriProtein, http://www.agriprotein.com/) est entrepreneur en Afrique du Sud et se définit lui-même comme un « écologiste capitaliste ». Il créée des activités à partir de concepts de récupération intelligente des ressources : par exemple, élever des mouches nourries grâce à des déchets d'abattoirs de volaille, pour revendre ensuite les larves de mouche comme nourriture à ces mêmes élevages de volaille. Plus généralement, son credo est de renouer le contact perdu avec la nature depuis la révolution industrielle, afin d'identifier des solutions simples et respectueuses de l'environnement à nos problèmes de ressources en matières premières, énergie, eau… « Nous devons cesser d'essayer d'industrialiser la nature », dit-il.

Sanjit 'Bunker' Roy (Barefoot College, http://www.barefootcollege.org/) est un militant et éducateur indien qui fait passer l'électrification des villages dans les pays du tiers monde par la formation de femmes illettrées à l'installation et l'entretien de panneaux solaires. En effet, se basant sur le constat que « les hommes sont agités, ambitieux, et veulent tous un diplôme afin de quitter leur village et trouver du travail à la ville », il estime que les former est inutile. En revanche, les femmes qu'il appelle des « grands-mères », c'est-à-dire les mères de famille ayant plus de 35 ans, sont les plus fiables pour apporter ces compétences dans leur village et les y entretenir et diffuser sur le long terme.

Vu et entendu… par les FEL

« Nous nous attendions à… »

Au vu des récents développements de l'actualité énergétique, des entreprises présentes au congrès, de nos expériences précédentes en conférence, nous nous attentions à certaines choses et nous avons été surpris…

Nous nous attendions à :
- beaucoup de débats sur les gaz de schiste
- des perspectives sur le CCS pour la poursuite de la consommation des fossiles
- des interventions systématiquement appuyées sur un support numérique du type Powerpoint
- des FEL qui nous ressemblent : doctorants ou jeunes docteurs
- des intervenants majoritairement issus de l'industrie

Finalement :
- très peu de mentions sur les gaz de schiste
- des perspectives volontaristes et encourageantes sur les renouvelables
- de nombreuses prises de position sur l'importance de la pauvreté énergétique
- des interventions systématiquement et intégralement sans support numérique
- des FEL aux profils diversifiés : entrepreneur, conseiller de ministre...
- des entrepreneurs innovants : Jason Drew, Bunker Roy... et une forte implication des politiques, avec de nombreux ministres de l'énergie, des personnalités de l'ONU (Dr Yumkella), mais aussi les interventions du Premier Ministre Coréen lors de la cérémonie d'ouverture le 13 octobre, et de la Présidente de Corée le 16 octobre.

Remarque : étonnamment, le sujet des gaz de schiste a été peu abordé durant les sessions plénières auxquelles assistaient les FEL. Néanmoins des discussions avec des chercheurs hors du programme FEL nous ont appris que les sessions d'experts qui se déroulaient en même temps que les sessions FEL avaient beaucoup traité le sujet, ainsi que celui du nucléaire.

Ils ont dit…

Durant le Congrès, les participants et le CME ont eu une intense activité de communication sur les réseaux sociaux et la toile. Voici un florilège des tweets (traduits de l'anglais) lus pendant les quatre jours.

Les enjeux énergétiques

« Les enjeux principaux du secteur sont la technologie et les politiques publiques. » Philippe Cochet (Président Alstom Thermal) in *Energy and climate scenarios: From vision to reality* (Jour 1 : Vision et scénarios pour le futur).

« Le Trilemme énergétique mondial en appelle à l'énergie pour la prospérité, et non pas l'énergie pour l'énergie. […] Nous devons faire en sorte que les projets d'électrification de petite taille dans les pays en développent soient attractifs aux investisseurs. […]
L'Afrique doit reformer son système de droits de douane sur les panneaux solaires. » Kandeh Yumkella (ONU).

« L'enjeu de l'Afrique c'est l'accès à l'eau. » Brian Dame (PDG Eskom) in *Energy and climate scenarios: From vision to reality* (Jour 1 : Vision et scénarios pour le futur).

« Le changement climatique est galopant. La récente diffusion à Stockholm du dernier rapport montre des conclusions plus affirmées, les scientifiques sont plus sûrs de leurs hypothèses, et la participation de l'homme plus significative. Il doit y a voir une transition « juste » entre les hydrocarbures et les renouvelables. […] Les problèmes de sécurité énergétique ne doivent pas nous faire oublier les risques associés aux problèmes de sécurité alimentaire et d'accès à l'eau. » Samantha Smith (WWF) in *Tomorrow's Energy: Connecting the Dots* (Jour 1 : Vision et scénarios pour le futur).

« La connectivité fait partie des enjeux de la résolution des problèmes du secteur de l'énergie […] »

« Sans sécurité énergétique, toutes les bonnes intentions du monde sont sans effet. » Alexander Novak (Ministre de l'Énergie, Russie).

« L'accès à l'énergie pour 1,3 milliars d'humains sans électricité est un enjeu économique, social et surtout moral. » Fatih Birol (Chef économiste IEA) in Table-Ronde FEL *Scénarios pour le Futur* (Jour 3: The Energy Trilemma: Policy Solutions to Secure Prosperity).

Sur le prix du pétrole

« On ne parle plus du peak oil! Le pétrole est abondant. Néanmoins la transition énergétique est nécessaire mais elle ne va pas sans l'amélioration des capacités d'extraction. » Khalid Al-Falih (PDG Saudi Aramco) in *Impacts mondiaux et enjeux de l'industrie de l'énergie* (Jour 1 : Vision et scénarios pour le futur).

« Le problème du peak oil n'est pas derrière nous ! » Jeremy Leggett (PDG Solar Century) in Table-Ronde FELP Assessing the Global Energy Agenda.

Sur les choix technologiques

« Les frontières technologiques actuelles sont le développement du gaz et des renouvelables à grande échelle, le stockage et le développement de la production d'énergie décentralisée. […] Le maintien du charbon et du nucléaire dans le mix énergétique est nécessaire. […] Il y a une valeur économique énorme à capturer dans l'amélioration de la prévision de fonctionnement de l'éolien. […] Les actions à mener sont 1- des politiques publiques en faveur de l'investissement et des marchés concurrentiels et 2- la communication et la formation des acteurs et des consommateurs.» Steve Bolze, (PDG GE Power and Water) in *Impacts mondiaux et enjeux de l'industrie de l'énergie* (Jour 1 : Vision et scénarios pour le futur).

« Dans le nucléaire il n'y a pas de lumière sans ombre. » M. Masumoto (conseiller pour le ministère de l'énergie au Japon) in *Energy and climate scenarios: From vision to reality* (Jour 1 : Vision et scénarios pour le futur).

Sur la régulation des marchés

« Les marchés sont le moyen de diffuser la technologie à un prix compétitif. […] Le secteur a besoin d'un environnement politique clair et stable sur le long terme. […] Il faut que les efforts faits par les européens et le système énergétique induit servent d'exemple pour le monde et ne soit pas une solution exclusivement européenne. L'Europe a trop subventionné et pas assez investi, pensé de manière sectorielle et non macroéconomique. » Leonhard Birnbaum (EON) in *Tomorrow's Energy: Connecting the Dots* (Jour 1 : Vision et scénarios pour le futur).

« Nous devons faire migrer les politiques énergétiques d'un système d'offre à un système de demande et se concentrer sur la maîtrise de cette dernière. » Hur, Dong-Soo (Président GS Caltex) in *Tomorrow's Energy: Connecting the Dots* (Jour 1 : Vision et scénarios pour le futur).

« Il n'y a pas de marché de l'énergie dans les pays en développement. Cela représente un poids supérieur pour ces pays dans le développement de leur industrie car il passe par un système de subventions aux entreprises. […] Il faut développer l'énergie de manière décentralisée (off grid) pour les pays en développement, penser autrement que par le système traditionnel de réseau. » Zola Tsotsi (Chairperson, Eskom) in *Tomorrow's Energy: Connecting the Dots* (Jour 1 : Vision et scénarios pour le futur).

« Le challenge de l'Europe c'est de trouver le moyen de sortir de notre système subventionné. […] Les subventions sont comme un médicament, au début ça fait beaucoup d'effet et sur le long terme cela vous gâte... » Michael Suess (PDG Siemens Energy) in *Tomorrow's Energy: Connecting the Dots* (Jour 1 : Vision et scénarios pour le futur).

« Un marché ne fonctionne pas si l'état n'en a pas fixé les règles. […] Nous devons fixer une date pour interdire l'usage du charbon en Europe et fermer les centrales électriques inefficaces. » Karl Rose (CME) in Table-Ronde FEL *Scénarios pour le Futur* (Jour 3: The Energy Trilemma: Policy Solutions to Secure Prosperity).

Marie-José Nadeau, addressing to the FEL, WEC Daegu 2013

« Les politiques publiques sont nécessaires mais elles sont inutile s'il n'y a pas d'autorité pour vérifier qu'elles sont appliquées. » Ged Davis (PDG Forescene SA) in *Today's energy: Are we at a tipping point? – Redefining resilience* (Jour 4 : Securing a Sustainable Energy Future).

« Les propositions des experts doivent être suivies d'actions. » M.Lee (IPCC) in *Energy and climate scenarios: From vision to reality* (Jour 1 : Vision et scénarios pour le futur).

« Nous devons être créatifs et imaginer des environnements d'investissement pour les pays en développement. » Jim Rogers (PDG Duke Energy).

Christiana Figueres (UNFCCC) a donné un exemple de projet solaire hors réseau au Kenya financé par le crowdfunding.

« Les politiques d'investissement dans les renouvelables sont peu claires et peu stables, limitant ainsi les investissements. » Ricardo Melendez-Orti (PDG ICTSD).

Sur l'acceptation sociale des choix énergétiques

« L'opinion et le soutien du public sont nécessaires à l'implémentation des scénarios, donc la communication est essentielle pour que les projets soient clairs et le soutien entier. » Ged Davis (PDG Forescene SA) in *Energy and climate scenarios: From vision to reality* (Jour 1 : Vision et scénarios pour le futur).

« Les professionnels de l'énergie doivent améliorer la transparence et la communication dans l'énergie, citer et vérifier les faits et les résultats scientifiques. » Karl Rose & Samantha Smith in Table-Ronde FEL *Scénarios pour le Futur* (Jour 3 : The Energy Trilemma: Policy Solutions to Secure Prosperity).

Sur les changements de mentalités

« Il faut décentraliser l'énergie et rendre la population responsable, même dans les pays développés. » Walter Steinmann (Secrétaire d'État à l'Énergie, Suisse).

« On ne peut pas être un écolo ou un capitaliste, il faut être les deux à la fois. […] Nous devrions nourrir les poissons avec des insectes et non pas du poisson ! Si un poulet était supposé manger du poisson, cela s'appellerait une mouette. […] La révolution industrielle est terminée, la révolution durable commence. » Jason Drew (PDG AgriProtein) in FELP Fire-starter (Jour 2 : Identifying the Business Opportunities: Resources and Technologies).

« Ne laissez pas l'université entraver votre formation ! L'avantage des personnes illettrées c'est qu'elles n'oublient jamais ce qu'elles ont appris. […] Les femmes restent dans leur village, tiennent leurs familles et leurs communautés. » Bunker Roy (Fondateur Barefoot College).

« Regardons nos voisins. Il y a beaucoup à apprendre de ce qui a été fait. Ce n'est pas la peine de répéter les erreurs du passé. » Maria van Der Hoeven (AIE) in *Overcoming the energy policy trilemma* (Jour 3 : The Energy Trilemma: Policy Solutions to Secure Prosperity).

Le message des FEL

Le message adressé par le groupe des FEL lors de la cérémonie de clôture se résume à trois phrases qui résument les enjeux et indications communes au travail des groupes thématiques.

En anglais :

- Embrace the change
- Let's add songs to the play list
- Make the most of it

Et en français avec quelques éléments de contexte :

- **Accueillons le changement**

Le changement est un fait. Qu'il soit climatique, financier, industriel ou social, nous devons l'assumer et le voir comme une opportunité pour développer des solutions énergétiques qui répondent au Trilemme du CME.

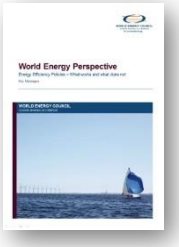
- **Élargissons notre horizon musical**

Nous apprécions la pertinence des scénarios Jazz et Symphonie proposés par le CME, mais nous aimons aussi la pop, le rock, le RnB et même le Gangnam Style. Il n'y a pas qu'un scenario. Il faut ouvrir le champ des possibles et proposer un choix plus large de solutions aux décideurs en termes de financement, de technologie, de politiques publiques. C'est par un portefeuille d'options riche que le Trilemme sera résolu.

- **Tirons le meilleur parti des ressources**

Les ressources ne sont pas seulement la matière première mais aussi la technologie, les hommes, le savoir-faire... Les ressources sont là mais elles sont sous exploitées. Il faut tirer le meilleur parti de l'ensemble des ressources et améliorer la diffusion des savoirs. Ouvrons les frontières par l'éducation et la coopération et soyons efficaces dans l'utilisation de l'ensemble de ces ressources.

Les politiques d'efficacité énergétique dans le monde



L'étude du Conseil Mondial de l'Énergie révèle un **ralentissement de l'efficacité énergétique** malgré une participation croissante des gouvernements.
La dernière étude du Conseil Mondial de l'Énergie sur les politiques d'efficacité énergétique fait état d'un ralentissement général de l'amélioration de l'efficacité énergétique.

Le rapport « Les politiques d'efficacité énergétique dans le monde », est réalisé en collaboration avec l'ADEME, l'agence de l'environnement et de la maîtrise de l'énergie en France. Le rapport montre que de plus en plus de pays sont maintenant impliqués dans la mise en œuvre de politiques d'efficacité énergétique, mais met aussi en lumière de nombreux facteurs qui ont influé les progrès de l'efficacité énergétique dans 85 pays, représentant plus de 90 % de la consommation mondiale d'énergie.

Commentant les résultats du Congrès Mondial de l'Énergie, François Moisan, directeur exécutif de l'ADEME et président du rapport, a déclaré :

« Notre dernière étude montre l'intérêt croissant pour l'efficacité énergétique de la plupart des gouvernements. Environ 80 % des pays étudiés ont des objectifs d'efficacité quantitatifs, alors qu'il y a six ans, seulement 40 % avaient de tels objectifs. Les labels et les normes pour les appareils d'efficacité énergétique sont mis en œuvre dans tous les pays de l'OCDE et dans 90 % des pays asiatiques. Les réglementations sur les équipements efficaces et les bâtiments consommateurs d'énergie restent les mesures les plus couramment déployées. Les progrès en matière d'efficacité énergétique au cours des 20 dernières années équivalent à un tiers de la consommation mondiale d'énergie primaire en 2011 ».

Christoph Frei, Secrétaire général du Conseil Mondial de l'Énergie, a déclaré que le ralentissement de l'amélioration de l'efficacité énergétique doit être stoppé, renversé si les progrès futurs devaient être faits sur une base stable et durable :
« La demande d'énergie continue de croître, mais sur un rythme qui ralentit. Toutefois, le taux de diminution de l'intensité énergétique a baissé à un rythme beaucoup plus net. Si les perspectives d'investissement incertaines, créés par la crise économique mondiale, expliquent en partie cette baisse, c'est la croissance de certaines utilisations de l'énergie comme l'électricité des ménages et le transport routier qui deviennent préoccupantes. Ce problème est aggravé par la hausse continue de la demande d'énergie, tirée par la croissance hors OCDE où l'intensité énergétique est plus élevée que dans la plupart des pays de l'OCDE ».

L'étude montre que la plupart des pays ont considérablement réduit leur consommation d'énergie primaire par unité de PIB au cours des trois dernières décennies de l'ordre de 1,3 % par an en moyenne dans le monde. Les améliorations sont en grande partie attribuables aux usages finaux les plus importants tels que les véhicules, les appareils électroménagers, le chauffage des bâtiments et les procédés industriels. Les nouvelles normes, les campagnes de sensibilisation et les exigences réglementaires ont contribué à améliorer l'efficacité énergétique dans les pays de l'OCDE. Le développement de la technologie, la réponse à la hausse des prix de l'énergie et la concurrence croissante dans l'industrie, ont également contraint les entreprises à réduire leurs coûts énergétiques.
C'est en Europe de l'Ouest que l'on observe actuellement le plus faible niveau d'intensité énergétique, alors que la CEI a la plus forte des grandes régions de consommation, en utilisant trois fois plus d'énergie par unité de PIB que l'Europe.

La Chine, l'Afrique et le Moyen-Orient ont tous des intensités énergétiques deux fois plus élevées que la moyenne européenne, tandis que celles de l'Amérique latine et l'Asie-Pacifique de l'OCDE sont environ 15 % plus élevées. L'Inde et d'autres pays asiatiques ont leur intensité énergétique environ 50 % supérieures à celle de l'Europe, celle de l'Amérique du Nord environ 45 %. Les intensités énergétiques élevées peuvent être attribuables à un certain nombre de facteurs : la structure de l'industrie, des prix bas de l'énergie, et la part des industries intensives en énergie, par exemple.

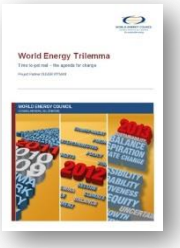
Les « Scénarios Mondiaux de l'Énergie à l'horizon 2050 » du CME estiment que la demande mondiale d'énergie va croître d'un tiers entre 2010 et 2035, dont 90 % hors OCDE. La Chine et l'Inde compteront pour la moitié de cette croissance, la Chine représentant à elle seule un tiers. Toutefois la consommation énergétique par habitant de la Chine en 2035 sera toujours moins de la moitié de celle des États-Unis ou de l'Australie.

Christoph Frei conclu :
« Bien qu'il soit important de reconnaître où des progrès ont été réalisés, il est également crucial de savoir quand le rythme du changement se modifie, et pourquoi. Le développement d'actions avec de nouvelles politiques et stratégies d'efficacité énergétique n'a jamais été plus urgent. Chaque région du monde, l'OCDE et d'autres, ont toutes un rôle à jouer et nous sommes impatients d'engager la discussion sur la façon de mettre en œuvre ces nouveaux processus sur une base durable de long terme au cours du Congrès Mondial de l'Énergie »

Le rapport d'efficacité énergétique recommande neuf propositions clefs de politiques d'efficacité énergétique qui aideront à intégrer l'efficacité au sein du futur agenda :

- Les prix de l'énergie devraient refléter les coûts réels d'approvisionnement et ainsi s'assurer que les consommateurs reçoivent les bons signaux de prix.
- Les consommateurs ont besoin d'informations pour être en mesure de prendre les bonnes décisions.
- La facturation intelligente représente un potentiel important d'économies d'énergie.
- Les outils de financement innovants sont nécessaires pour soutenir les investissements des consommateurs.
- La qualité des équipements et services économes en énergie devrait être vérifiés.
- Les règlementations devraient être appliquées correctement et régulièrement renforcées.
- Le comportement des consommateurs devrait être examiné et faire l'objet d'attention, en particulier en relation avec le développement des TIC.
- Il est nécessaire de surveiller les tendances en matière d'efficacité énergétique pour être en mesure d'évaluer l'impact réel des politiques d'efficacité énergétique.
- La coopération internationale et régionale en faveur de l'efficacité énergétique devrait être renforcée.

World Energy Trilemma: Time to get real – the agenda for change



WORLD ENERGY COUNCIL ISSUES 10-POINT ACTION PLAN FOR SUSTAINABLE FUTURE

Report lays out collective path for governments, industry, and finance

The World Energy Council issued a 10-point action plan for how governments, industry, and key decision-makers should refocus their efforts and resources to achieve real progress in resolving the energy trilemma.

The report, "World Energy Trilemma: Time to get real – the agenda for change", was launched as the world's energy leaders gather in South Korea for the World Energy Congress. It provides a detailed guide to creating a global policy framework that addresses the energy trilemma: energy security, energy equity, and environmental sustainability.

The report is the culmination of the findings of a two-year study, "World Energy Trilemma", conducted with Oliver Wyman, the management consulting firm. Recommendations from the past two years of study were the result of interviews with over 100 energy leaders in 41 countries, including chief executives, ministers, and heads of development banks.

Joan MacNaughton, Executive Chair of the WEC's World Energy Trilemma studies, said:

"Governments face a daunting challenge to deliver secure, affordable and environmentally sustainable energy services. How well they meet it has a fundamental bearing on the social and economic prospects of their countries. Over the last two years our World Energy Trilemma study has identified what governments and energy leaders believe is needed to balance the energy trilemma.

"These leaders say they are ready to act now, but acknowledge that they need more guidance and support. Our analysis provides the basis for countries to assess their political and institutional risk, and our new 'Agenda for Change' report describes how they can mitigate such risk and unlock the investment to deliver the required energy infrastructure. This subject will be the core of discussions between government and business leaders at the World Energy Congress'.

The WEC's 10-point *Agenda for Change* action plan includes:

- Action 1: Connect the energy trilemma to the broader national agenda

- Action 2: Provide leadership to build consensus – nationally and globally
- Action 3: Improve policymaker dialogue
- Action 4: Increase engagement with the financial community
- Action 5: Minimise policy and regulatory risk and ensure optimal risk allocation
- Action 6: Adopt market-based approaches to carbon pricing to drive investments
- Action 7: Design transparent, flexible and dynamic pricing frameworks
- Action 8: Drive (green) trade liberalisation
- Action 9: Meet the need for more research, development & demonstration (RD&D)
- Action 10: Encourage joint pre-commercial industry initiatives, including early large-scale demonstration and deployment.

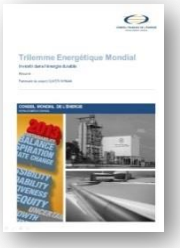
According to the report, addressing strong demand growth, widening access to the 1.2 billion people currently not served by energy grids, and balancing the upgrade of ageing infrastructure with environmentally progressive systems requires investment and coordination on an unprecedented scale. However, the impact of shale gas discoveries in more than 40 countries, cost breakthroughs in certain renewable technologies, and increasing the efficiency of transport, construction and household energy use could enable communities to live and work within a widely more sustainable energy landscape.
The report calls for better consultation and coordination between policymakers, industry, consumers and developers to create a sustainable energy framework that has the support of all stakeholders.

Christiana Figueres, Executive Secretary of the UN Framework Convention on Climate Change (UNFCCC), commented at the launch of the report at Daegu:
"The UN Intergovernmental Panel on Climate Change clearly sounded the alarm that greenhouse gas emissions will cause tremendous and irreversible harm to the economies of the world if not quickly curbed. The good news is that the money, technology and policy tools to shift the current emissions trajectory and steer humanity out of the danger zone are available. The Trilemma report demonstrates that a sustainable energy future is possible if all of these tools are deployed quickly and at scale. It also shows a strong willingness to act by the energy sector. I recommend that governments look closely at the report and act on its conclusions, which will strengthen the outcome of the 2015 global climate agreement and raise immediate ambition to curb greenhouse gases."

Christoph Frei, Secretary General of the World Energy Council, said:
"We stand on the verge of a genuinely more sustainable energy future. Technology is developing at an unparalleled pace and could unlock new opportunities to meet the needs of consumers and businesses. But daunting challenges remain. Our Agenda for Change provides new hope for the world's energy leaders to redouble their collective efforts to put the policies and plans in place that will create a global sustainable energy framework."

John Drzik, CEO of Oliver Wyman, project partner to the WEC on the Trilemma studies, said:
"Economic growth requires sustainable energy, and sustainable energy requires sustainable policy. Our study with the World Energy Council shows that many countries have made huge strides, but all need to do more. Business and political leaders need to work together to shape long-term energy policies which reduce risk and create a more favourable environment for energy investment."
The publication of today's report follows the launch last month of the WEC study, "*World Energy Trilemma: Time to get real - the case for sustainable energy investment",* and its *2013 Energy Sustainability Index*.

World Energy Trilemma: Time to get real – the case for sustainable energy investment



SUSTAINABLE FUTURE DEPENDENT ON ENERGY INDUSTRY SUPPORT, WARNS WORLD ENERGY COUNCIL

Report's rankings reveal most countries struggle to balance energy needs

- France is ranked **10th** in updated Energy Sustainability Index.
- Switzerland, Denmark, Sweden, Spain and the United Kingdom achieve 'AAA' ratings under new scorecard system.

The global energy industry must play a greater role in the transition to sustainable energy systems if United Nations development goals are to be met, warns a report launched today by the World Energy Council.
The potential for billions of people benefiting from sustainable energy systems in future decades hangs in the balance without increased private sector support, it says.

The WEC's 2013 World Energy Trilemma report, "Time to get real – the case for sustainable energy investment", was produced with global management consulting firm Oliver Wyman. The findings are based on interviews with more than 50 policymakers, including energy and environment ministers, leaders in development banks, governments, IGOs and NGOs, plus experts from more than 25 countries.

The policymakers interviewed expressed concern that the lack of global consensus on climate change and a future energy system framework, coupled with dramatic disruptions caused by emerging technologies and rapidly shifting patterns of energy use and supply, make it difficult to develop and implement long-term energy policies. This results in increased risk for industry and investors, which must be addressed if the much-needed energy transition is to be delivered in the future.

The report also reveals the results of the 2013 Energy Sustainability Index. The Energy Sustainability Index within the report is the world's most comprehensive ranking of countries energy policies and evaluates how well 129 countries balance the three conflicting agendas involved in achieving energy sustainability – what the WEC has called the 'energy trilemma'; energy security, energy equity and environmental sustainability.

The Index shows that developed countries with higher shares of energy coming from low- and zero-carbon energy sources supported by well-established energy-efficiency programmes, such as Switzerland, Denmark and Sweden, outperform most countries across all three dimensions of the energy trilemma. Nevertheless, it is clear that all countries still struggle to balance all three aspects of the trilemma's currently conflicting agendas. Only five countries in the top 10 have been awarded a 'AAA' score with Switzerland, Denmark, Sweden, the United Kingdom and Spain being the only countries that historically demonstrate their ability to manage the trade-offs between the three competing dimensions equally.

Pierre Gadonneix, Chairman of the World Energy Council, said:
"I am encouraged that there appears to be a growing consensus among both industry and policymakers on the nature of the challenge and what needs to be done.

Joan MacNaughton, Executive Chair of the World Energy Trilemma report, said:
"If countries are to improve the sustainability of their energy systems, they must continue to work hard at identifying and successfully implementing balanced and forward looking policies. A more sophisticated and proactive partnership with the private sector is also necessary to drive the higher level of energy investment now required.
"For its part, the private sector needs to better understand how policy is made and how to contribute to it more effectively. It should also be more proactive in helping to build an informed consensus that moves us away from ad hoc approaches dominated by debate about short-term costs."
Calling for closer public-private partnership to help overcome these challenges, the policymakers interviewed for the report urge the energy industry to contribute to and promote a long-term energy vision with realistic targets.

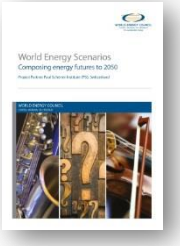
Their recommendations include:

- **Be more proactive in improving energy policies**
  To make sustainable energy systems a reality, energy leaders must take the initiative in sharing their knowledge, insights and experiences with policymakers, regulators and other stakeholders.

- **Be less risk averse regarding energy investments**.
  Cash-strapped governments with limited funds look to the energy and financial sectors to take the lead in energy infrastructure and technology investments. The report recommends a better alignment of risk with those best able to bear it and urges the private sector to engage with other stakeholders to identify suitable approaches and mechanisms to achieve a better balance of risk. The crucial role of both the public and private sectors in encouraging the research, development and demonstration (RD&D) of new energy technologies and innovations is also recognised.

- **Help developing countries chart a new energy course**
  The energy industry and other investors must work with public sector stakeholders to identify and lower the barriers that are holding up investment in least-developed, developing and emerging economies. The industry also needs to be more proactive in helping developing countries adopt proven technologies, working with them to reduce the cost of technology transfer and identifying suitable projects that can attract investment.

World Energy Scenarios: Composing energy futures to 2050



WEC WORLD ENERGY SCENARIOS REPORT HIGHLIGHTS MASSIVE CHALLENGES TO ACHIEVING HARMONY IN THE ENERGY SYSTEM

The world is set to face several significant challenges in balancing global energy needs in addressing the energy trilemma over the next four decades, according to the report, "World Energy Scenarios: Composing energy futures to 2050", released by the World Energy Council at its triennial event, the 2013 World Energy Congress, in Daegu, Korea.

Total primary energy supply is set to increase to 2050 by between 61% and 27%, with fossil fuels remaining the dominant energy source supplying between 77% and 59% of the global primary energy mix.

The report's conclusions follow a three-year study conducted by over 60 experts from nearly 30 countries, with modelling provided by the Paul Scherrer Institute, Switzerland's largest research centre for natural and engineering sciences. The report assesses two contrasting policy scenarios, the more consumer-driven Jazz scenario and the more voter-driven Symphony scenario, with a key differentiator being the ability of countries to pass through the Doha Climate Gateway. The WEC scenarios use an explorative approach to assess what is actually happening in the world now, to help gauge what will happen in the future and the real impact of today's choices on tomorrow's energy landscape.

Rob Whitney, the New Zealand based Chair of the World Energy Scenarios report, said: "We have been able to bring together an unparalleled team to work on these unique explorative scenarios. Rather than telling policymakers and senior energy leaders what to do in order to achieve a specific policy goal, the WEC's World Energy Scenarios will allow them to test the key assumptions that they decide to better shape the energy of tomorrow. That's why these findings are so powerful."

Under Jazz, total primary energy supply could increase by 61% by 2050, while under Symphony these supplies could rise by only 27%, thus highlighting the impact that choosing one policy solutions or the other can have on the energy sector.
While the share of renewable energy sources in the global energy mix will record the biggest growth to reach 20%in Jazz and 30%in Symphony by 2050, both scenarios show that fossil fuels will remain the dominant resource in the future, accounting for 77% in Jazz and 59% in Symphony.

Transport fuels almost double in Jazz with much of the increase coming from conventional fuels and a switch to natural gas. In Symphony the increase is only 20% with most of the increase being biofuels and electricity.

By 2050, the use of solar for electricity generation is set to increase by up to 225 times over 2010 levels. Currently solar power only accounts for just over 34 TWh/y in the electricity generation mix, but it could provide somewhere between 2,980 TWh and 7,740 TWh in 2050. This equates to between US$2,950 billion and US$9,660 billion of investment in solar, representing the largest potential investment area of any renewable energy resource.

In order to cater to the rising electricity needs generated by economic development to 2050, the WEC estimates that the world will need to invest from US$19 trillion in Jazz to over US$25 trillion in Symphony for electricity generation alone, with the majority of investments required being directed towards solar PV, hydro and wind. Overall, global electricity generation capacity could increase by a slightly higher amount in Jazz than in Symphony, but in Jazz there would be much less investment in renewable electricity generation.

Karl Rose, Senior Director, Policies and Scenarios at the World Energy Council, said: "While there will be opportunities in the future for a range of technology solutions, the ultimate issue is that demand continues to grow at an unsustainable rate. One of the most significant findings in the report is the strong regional variation of priorities and solutions in the energy system. Too often we look at the world as one entity and seek global solutions but the reality is very different and this needs to be recognised."

While both scenarios see a significant increase in energy access, the rate of increase will remain insufficient. Globally, between 730 million and 880 million people will still be without access to electricity in 2030, predominantly in Sub-Saharan Africa, and this figure would only decrease to 319 million and 530 million people in 2050, according to the report.

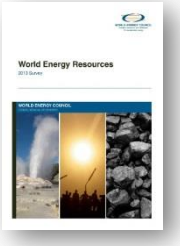
The African continent will face the biggest electrification challenge. Asia will account for the largest percentage of total primary energy consumption by 2050, at 48% under Jazz and 45% under Symphony. This compares to around 30% in both Jazz and Symphony for Europe and North America and underlines the major differences that regional priorities will take in building sustainable energy futures.

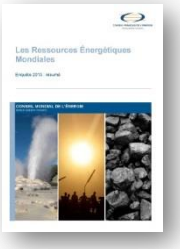
In terms of curbing CO_2 emissions, the Symphony scenario sees the world being able to decrease CO_2 emissions to 490-535 parts per million (ppm) by 2050. In contrast, the Jazz scenario will see emissions reach 590-710 ppm over the same period. Both emissions levels are in excess of the 450 ppm CO_2 target adopted by many. A significant reduction of CO_2 emissions is possible after 2020 in the Symphony scenario; however, it still leaves the emissions almost at double the amount with regards to the objective of halving emissions compared to 1990 levels.

The WEC further sees that at worst, greenhouse gas (GHG) emissions could be up to four times higher than the objective of halving emissions compared to 1990 levels.

Christoph Frei, Secretary General of the World Energy Council, concluded: "At a time of unprecedented uncertainty these Scenarios provide a stark warning to our energy future. Jazz and Symphony highlight the need for clear and robust policy frameworks that reduce political risk, the need for urgent focus in technology development and demonstration in electricity storage and CCS, and the need to manage our carbon budget and minimise our water footprint. Our findings challenge our understanding of and current ability to deliver the resilient infrastructure that we need to face the changes we expect to occur over the coming decades."

World Energy Resources: 2013 Survey





WORLD ENERGY COUNCIL REPORT CONFIRMS GLOBAL ABUNDANCE OF ENERGY RESOURCES AND EXPOSES MYTH OF PEAK OIL

There is a greater abundance of energy resources in the world today than at any other time, and, if properly managed, the reserves are sufficient to meet even a significant upturn in demand for decades to come, according to "World Energy Resources 2013", a report released by the World Energy Council at its triennial event, the World Energy Congress, in Daegu, Korea.

The report says that the increased assessment of reserves, along with improved energy production and conversion technologies, has enabled the energy industry to meet a growth in demand that is higher than was anticipated two decades ago.

Fossil fuels are still the dominant resource, providing 80% of energy, while new renewables (solar, wind, geothermal, marine) provide about 1.5% only. For electricity production, fossil fuels supply 66% (up by 2%), while new renewables supply around 5%. Over the last 10 years the share of coal has increased to around 28% (up by 4.5%), oil has decreased to 31% (down by 6%), while gas has increased to 23% (up by 2%).

The report also notes that the development of renewables has been significantly slower than was expected 20 years ago.

Christoph Frei, Secretary General of the World Energy Council, commented: "Our latest World Energy Resources report shows that 'peak oil' – that the world was running out of oil – has moved into a far future. It is clear that coal, oil and gas are going to keep powering the economies of many countries for many years to come."

According to the report, although renewable resources, especially wind power and solar PV, have developed exponentially, this started from a low base. Today renewables still represent a small fraction of total global energy supply.

Christoph Frei said: "Renewables will play an important role in our future energy mix. In particular, our World Energy Scenarios study sees that solar PV will have a bright future. However, a number of challenges for renewables remain. There is huge unexploited hydropower potential especially in Africa, Asia and Latin America, but a number of large projects are facing local resistance. There is significant potential of biomass energy, particularly in Latin America,

but concerns about the energy-water-food nexus have to be carefully managed. Other technologies, such as marine energy, still require a lot of efforts in RD&D."

A**lessandro Clerici, Executive Chair of World Energy Resources, commented**: "The growth of new renewables, namely wind and solar, has been mainly dependent on generous government support and subsidies especially in the EU. In addition, integrating a high percentage of intermittent renewables into the grid has remained challenging due to the high cost of storage and backup power. Intermittent renewables such as wind and solar will have an increased share in future electricity generation but they will still remain marginal in the global primary energy supply for decades to come."

The report also finds that the increase of renewables has not been enough to make up for the drop in nuclear energy, from a peak of 17% in the late 1980s to 13.5% in 2012. Nuclear energy faces an uncertain future, with the nuclear renaissance stalled following the Fukushima accident, the report adds.

Alessandro Clerici commented: "The growth of renewables will benefit from having conventional thermal plants with the right flexibility for power-frequency regulation and finding adequate storage and grid technologies. Meanwhile, energy efficiency presents an immediate opportunity to reduce both energy intensity and emissions. However, as energy-efficient systems are capital-intensive, decision-makers must abandon the usual short-term mentality to finance projects based on initial costs, to also account for the lower lifecycle costs."

The report concludes by noting that while the resources and technologies are available to meet rising demand, there are other constraints on the sector, most notably financing, the environment and climate.

Significant findings of the report are:

Oil

- Global crude oil reserves today are almost 25% larger than in 1993 and production has gone up by 20%.
- The oil reserves in the world could be quadrupled if unconventional resources such as oil shale, oil sands, extra heavy oil, and natural bitumen are taken into account.
- The report sets out a global oil reserves-to-production (R/P) ratio of 56 years with total available reserves estimated at 223 billion tonnes.

Coal

- Coal is still the global primary energy source (40%) for electricity production. Leading economies are still powered by coal, with 79% of electricity in China and 40% in the USA generated by coal-fired plants, respectively.
- The report sets out a global coal reserves-to-production ratio in excess of 100 years with total available reserves estimated at 891 billion tonnes.

Natural gas

- Natural gas is expected to continue to grow, thanks to significant increases in the reassessment of reserves and the growing contribution of unconventional gas, such as shale gas.
- The report sets out a global reserves-to-production ratio for natural gas at 55 years with total reserves estimated at 209 trillion cubic metres.

Nuclear

- The survey sets out that total identified uranium resources have grown by 12.5% since 2008 and are sufficient for over 100 years of supply based on current requirements.
- Nuclear power generated 2385 TWh in 2011.
- The nuclear share of total global electricity production reached its peak of 17% in the late 1980s, but since then it has been falling and reached 13.5% in 2012.

Hydropower

- Hydropower generated 2767 TWh in 2011.
- During 2012, an estimated 27 to 30 GW of new hydropower and 2 to 3 GW of pumped storage capacity was commissioned.
- Since the WEC's 2010 resources survey the total amount of electricity produced by hydropower has dropped by 14%, in part due to water shortages.

Wind

- Wind generated 377 TWh in 2011 from 240,000 MW of installed capacity.
- Total amount of electricity generated by wind in 2011 was roughly equal to Australia's annual electricity consumption.
- China, with about 62 GW, has the world's highest installed capacity of wind energy, while Denmark, with over 3 GW, has the highest level per capita.

Solar PV

- The global total of installed capacity for solar PV stood at 68,850 MW in 2011 with an energy production around 70 TWh.
- Between 2008 and 2011 solar PV capacity increased in the USA from 1168 to 5171 MW, in Germany from 5877 to 25,039 MW, and in Italy from 430 MW to 13000 MW.

Bioenergy

- Between 1990 and 2010 bioenergy supply increased from 38 to 52 EJ.

The report showcases the potential for energy efficiency to decrease the use of resources and achieve huge savings along the entire energy value chain. Examples include:

- Buildings account for almost 40% of global consumption and the report notes potential energy savings in buildings could reach between 20 and 40%.
- In oil & gas exploration the energy efficiency of the electric system, which today is 20%, could be increased up to 50%.
- In power generation the average efficiency of power plants is 34% for coal-fired installations compared with best available technology of 46% for coal and 61% for gas-fired units.

The report is the 23rd of the World Energy Council's resources studies, with the full report running to nearly 600 pages. The first report was published in 1933 and was entitled Statistical Year Book of World Energy, which later became the WEC Survey of Energy Resources. The series is regarded worldwide as the premier source of information on global energy resources and is made available free of charge via the World Energy Council's website: www.worldenergy.org/publications.

French speakers to express their views in WEC Daegu

- October 14:

  Vision and Scenarios for the Future

- October 15:

  Identifying the Business Opportunities: Resources and Technologies

- October 16:

  The Energy Trilemma: Policy Solutions to Secure Prosperity

- October 17:

  Securing a Sustainable Energy Future

Pierre Gadonneix

WEC Chair

13 October 2013 - Congress Opening Ceremony

Prime Minister Chung,
Mayor Kim, Mr Cho,
Excellencies,
Ladies and Gentlemen,

It is with both immense pleasure and great emotion that I now take the floor to offer you a warm welcome in Daegu, at our 22nd World Energy Congress!
WEC and its triennial congress have become over the years a unique platform for all energy stakeholders, and the congress is now the most inclusive global high-level gathering of the energy sector. WEC has been continuously grasping and tackling the challenges of the sector in the long term and taking steps to advise industry and government leaders on the long term future of energy.
In recent years, WEC has established itself a leading role as a global force in the world of energy. This change has been driven by a series of flagship publications that address the key issues facing global energy.

Four years ago, WEC launched a unique study assessing the energy and environmental policies around the world. Today, the World Energy Trilemma report, now in its fifth edition, covers more than 120 countries, showcasing best practices as well as failures and risks of energy policies as regards the three dimensions of the energy trilemma: energy security, environmental impact mitigation and social equity. The Trilemma report is timely, since all countries around the world are currently trying to fix new energy policies to transition towards a more sustainable future.
For example, 2013 proved to be the year when a greater number of countries committed to engage in a transition of their energy and economic system in order to reconcile economic growth with the protection of the environment and climate.
Be it China, where, for the first time in its history, the requirement of developing an “ecological civilization” was inscribed in 2013 in its national constitution…

Or be it the USA, where President Obama committed in a speech at Georgetown University in June, to concretely “act before it’s too late” and to focus on three pillars: “cutting carbon pollution in America, preparing the U.S. for the impacts of climate change, and leading international efforts to cut global emissions”.
But it is also true in Europe, where the mixed results of current energy and climate policies, pave the way for a new reflection on the best way forward from 2020 onwards with regards climate change policy.
Lastly, the energy and climate policies are also moving towards a transition in Latin America, namely in Brazil, where public acceptability of large energy projects competing with land and water uses is becoming increasingly critical and where the government is urged to find alternative, consensual trajectories to reconcile economic and energy growth with the environmental aspirations of the people on the long term.

WEC has been visionary in the way it identified the three dimensions but also their intimate bond one with another, and their urgency: we can no longer escape the reality of the energy trilemma.

Of particular concern is the fact that in 2013, of the 7 billion people alive on the planet, 1.2 billion subsist below the internationally accepted extreme-poverty line of $1.25 US a day. Not surprisingly, almost the same number of people - 1.2 billion - does not have access to water services or to electricity. As you all know, energy supply is one of the key drivers to pull people out of poverty. The main issue regarding access is, principally, not the amount of money needed[2]. Rather, it has much more to do with designing smart public policies, choosing the right technologies, building capacities, skills and supportive governance.
The task, to reconcile the three aspects of the trilemma - energy security, social equity and environmental impact mitigation - is a huge challenge. And, as time elapses, it will get even harder.

That is why it requires all stakeholders of the energy and climate sector to work on it now, and provide countries' leaders with insights.
Over the next four days, we will have the opportunity to discuss together how we can concretely reach that progressive approach and with which resources and technologies.

WEC is ready to grapple with the key issue of "securing tomorrow's energy today" which is the theme of this 2013 World Energy Congress, and, I believe, the very question at the heart of the world energy transition. This is why we are here for the next four days, to discuss the big energy issues and challenges facing us.

Thanks and have an Excellent Congress

Ribbon cutting ceremony to open the exhibition © World Energy Council

[2] $34billion/year of additional investment by 2030, only 3% of global investment in energy sector (AIE – WEO 2012)

Giles Dickson

Vice President of ALSTOM International
Environmental Policies & Global Advocacy

14 October 2013 - World coal outlook: Innovations for tomorrow's energy

What are the main drivers of coal demand?

- The need for new generation capacity. E.g. substantial new generating capacity is planned to be built throughout Asia-Pacific region, and coal is expected to account for 44% of this = 275GW
- The low cost of coal compared to other fuels: coal prices trending down since 2012. Today coal is only one-third of the cost of LNG in Asian markets and less than half the cost than gas in Europe; and linked to that
- The abundant supply of coal, especially the availability of indigenous coal in many markets, including low-grade and less expensive coal.
  - The amount of coal traded internationally is projected to keep growing, to rise 20% by 2020.
  - More of it will be lower-rank and lower-quality grades, notably lower-rank high moisture lignite from Indonesia, also lower CV coal with higher ash content from RSA and Australia.
  - For 30 years +, thermal coal grades traded internationally with average calorific value (CV) of 6,000 kcal/kg. In past three years, several new grades (4,200-5,500 kcal/kg) have been added to price indices, to reflect more lower-quality coal being traded
  - Countries with lower-grade coal reserves looking for ways to use them.
  - Construction of more advanced refineries increasing production of petcoke.
  - Use of lower-quality coals, either directly or in-blends, offers cost savings for power plants so drives further demand.

What are the impacts of shale gas?

- Reduced coal demand in the US.
- The increased availability of surplus US coal driving coal prices down, e.g. in Europe. Many US exports low-rank PRB coals and high sulfur Illinois coals.
- US exports of LNG will help bolster global gas supply, but will have little impact until late in the decade.

What is the most uncertain driver of coal demand?

The extent of the need or demand for new coal-fired generation capacity: e.g. regulatory / planning changes in China and growing constraints on new coal build and operation of inefficient coal plants.

What are the developments in clean coal?

Am defining clean coal as cleaner coal-fired power generation, i.e.:

- increasing the efficiency by upgrading temperatures and pressures in advanced boilers and steam turbines and

- developing the co-combustion of coal with biomass.
- reducing water footprint of coal-fired power generation
- AQCS, and CCS

Efficiency: Latest USC plants now operating at 600°C/620°C and 275 bar; at more than 47% efficiency (and 58% if district heating is considered). Which means 40% less CO_2 emissions than a coal-fired power plant built in the 1980s. Important progress made too on improving efficiency of existing coal-fired plants. New Alstom USC CFB boiler introduced this month allows more efficient use of the lower quality coals now increasingly in the market. Overall 207m tones mitigation pa from 1445 Alstom power projects since 2002. Most of it from thermal projects: new and existing plants.

Co-firing of biomass with coal: e.g. Drax power station in UK (2nd largest in Europe) now the single largest renewables installation in the UK.

CCS: Major Alstom R&D programme in CO_2 capture technologies: post-combustion capture and oxy-fuel combustion. 13 pilot plants ranging from 5MW to 58MW size: consistently achieve 90% capture and 99% purity. Next stage is full scale demonstration plant: "White Rose" in the UK. CCS cost-competitive with many renewables: €73/MWhr LCOE in Europe by early 2030s, €64 in NAL, €62 in East Asia. Much less than what e.g. offshore wind costs today. We also work on **2nd generation CO_2 capture** technologies such as CLC (Chemical Looping Combustion) and RCC (Regenerative Calcium Cycle), with promising performances and good prospects of further reduction in cost of electricity.

Air Quality Control Systems: Today's technologies eliminate more than 90% of NOx emission and more than 99% SO_2 and PM emissions.

Water: Agree with William Durbin that water consumption in thermal power plants is becoming a serious concern in several countries. Alstom is building the two largest air-cooled coal power plants in the world: Kusile and Medupi, in South Africa, with twelve 800 MW supercritical turbine islands with air-cooled condensers.

Policies for coal:

- Broad portfolio of all fuels and all technologies is the best solution to the energy trilemma. Put the eggs in as many baskets as possible.

- Coal has an important to play: given relative coal prices, it obviously ticks the competitiveness box and for those countries with indigenous supplies it ticks the security of supply box too. The challenge is to ensure it ticks the sustainability box as far as possible too.

- Government policy is key here. Regulation required to manage the air pollution from coal-fired generation: e.g. China now required all new coal-fired plants to be built with de-NOx and de-SOx. Government policy can also incentivise investment in the most efficient coal-fired plants: to ensure new plants are built with BAT; and to incentivise upgrading and retrofit of existing plants where it makes economic sense.

- Finally, government action is required to drive CCS. Support for crucial next phase of demonstration and first wave deployment. Look at RES: expanded on back of Feed in Tariffs and costs now come down. CCS needs the same. UK introducing FiT: others need to follow suit.

Olivier Appert

Chairman and CEO of IFP Energies Nouvelles
President of the Conseil Français de l'Énergie

14 October 2013 - Future of transport: decarbonizing growth

Transport technologies trend

As CEO of IFP Energies nouvelles and President of the Conseil Français de l'Énergie, I am pleased to present you an overview of future technologies in transportation sector. I would like to share with you some of our conclusions:

- Energy efficiency is a major challenge.
- New technologies will be developed in order to improve energy efficiency in transport sector and develop alternative fuels.

In the long term, there will be an on-going growth of mobility driven by world economic growth.
Energy efficiency is a major challenge. We need to remind that the efficiency of internal combustion engines averages only 20% in urban uses.
It is useful to look at past efficiency trends, since they provide insight into what the future might hold. Comparisons between efficiencies in different countries also provide pointers.
Since 1980, fuel efficiency has improved in all IEA countries. It has risen by an average of 20% within the vehicle stock as a whole. But important regional differences should be noted. The average car in the United States uses about 35% more fuel per kilometre than the average European car. This gap can be attributed to fuel tax and sizes of income, and also of technological variations.
Increasing energy efficiency standards is a first response from policy makers worldwide. For example, the United-States have set up the average fuel efficiency standard of 35.5 mpg in 2016 and the European Union has decided to reduce the CO_2 emissions of car down to 95 g/km in 2020.
The fuel consumption of vehicles is directly related to the power delivered by the engine in response to the speed requested by the driver. This power is used to overcome three resisting forces:

- friction, which combines rolling forces (tire, rolling) and transmission forces–to a first approximation, proportional to the speed of the vehicle;
- an aerodynamic force that depends on the frontal area of the vehicle, on its drag coefficient (Cx), and on the square of the speed;
- when accelerating, the inertia of the vehicle and of its rotating parts (mainly the wheels and the transmission).

So reducing tire friction is a major development theme for equipment suppliers. Improving the aerodynamic performance of vehicles seems to be becoming more and more difficult because of vehicle design requirements. We can however report that newer vehicles offer SCx coefficients – the product of the frontal area S by the Cx– that are relatively low. Reducing vehicle weights is another option, for example by making them smaller or using of materials having lower densities.
Significant improvements on traditional IC engines may increase fuel efficiency. For instance, this may be achieved on gasoline or diesel engines with new combustion processes (direct injection, lean burn engines, CAI) downsizing and/or cylinder deactivation, variable compression ratio or valve train. New technologies may be developed to reduce pollutant emissions of diesel

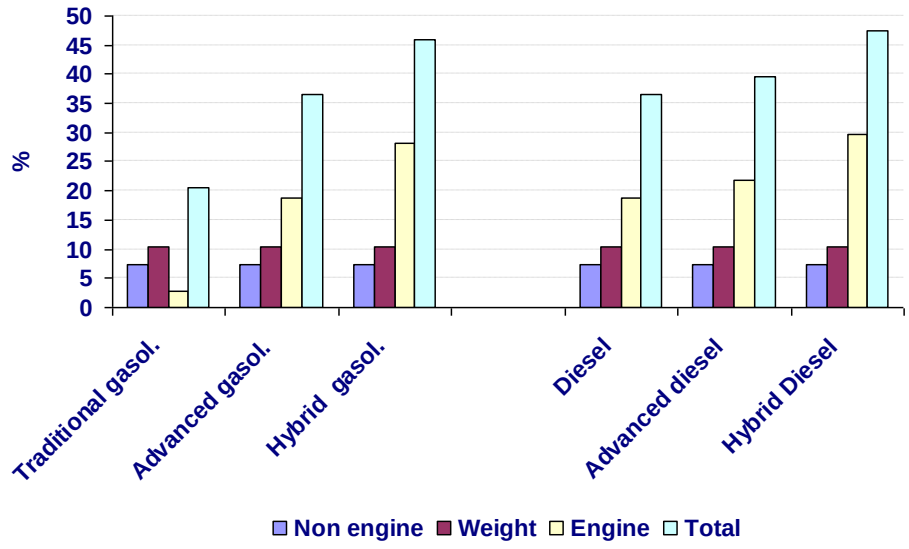
engines through particulate filters, oxidation catalyst improvement or NOx absorber. Efficiency improvement may reach 20 to 30% for gasoline engines and 10 to 15% for diesel engines.

Another way to reduce consumption and CO_2 emissions is to **develop alternative engines**. This is the case of vehicles with dedicated engines such as natural gas, DME or may be hydrogen on the long term. Electric vehicle is an option developed recently in some OECD countries: but it is penalized by the short range (100 to 200 km under real conditions of use) associated with today's batteries. The hybrid power pack combining electric and thermal engine looks very promising in the medium term.

Hybrid technologies will have a major impact in order to improve energy efficiency.
Electrifying the propulsion systems of vehicles provides a number of functions that can help reducing energy consumption. This is achieved by optimizing the operating conditions of the heat engine and by recovering a variable fraction of the available energy during braking. The simplest systems which make it possible to eliminate idling, yield fuel savings of 5 to 7% in the standardized European cycle. The most complex systems which provide more functions lead to saving up to 40%.

On average, hybrid technology may reduce energy consumption by 35% compared to gasoline engine and 20% for diesel.
As a result, the potential fuel economy is significant. A reduction of 20 to 50% is feasible based on non-engine (aerodynamics, rolling resistance, energy management, weight reduction) and engine improvements.

Potential fuels economy improvements



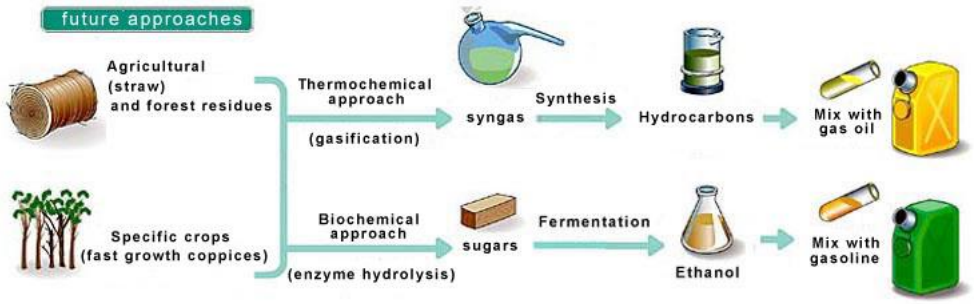
The demand for air transport is also increasing very rapidly. But the climate change challenge is putting a strong pressure on the aviation sector. Energy consumption may be reduced thanks to different new technologies and operational measures: frozen technology 5% pa, fleet replacement with new technology aircraft -1.3% pa, better aircraft utilization -0.3% pa, infrastructure measures…

As a result, it's possible to reduce by a factor of two CO_2 emissions of the transport sector by 2050 compared to 2005.

Another route to reduce CO_2 emissions of transport sector is to develop substitute petroleum products.

Biofuels are the most significant alternative led by United States and Brazil. In most cases, they are blended into conventional gasoline or diesel requiring no change to the vehicle if mixtures are kept within certain limits. Their share of total road transport energy use is around 3.5%.
In many countries, First generation biofuels are now facing public acceptance challenges. Second generation biofuels from non-food biomass will be developed rapidly in the coming decades.
As a result, we may anticipate that the share of biofuels may increase up to 8.6% of road transport energy.

Second generation biofuels

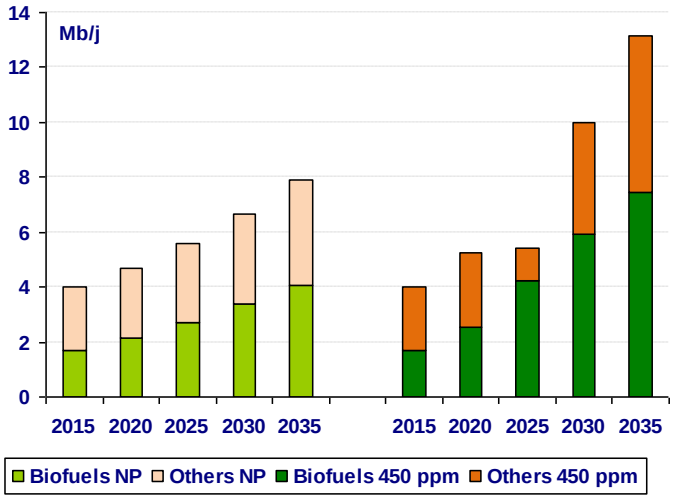


There are many other alternatives.
LPG is a first option well developed in many countries. We may anticipate that their share may almost double from 1.5% to 2.6%.
Natural gas vehicle is already an attractive option from countries with significant gas reserve. Global sales of NGV would increase fivefold and the share of gas globally reaching 4.6% in 2035. We may also anticipate a significant development of LNG as an alternative to diesel for long-haul trucking. In the US alone, it may displace around 400 kbd.

GTL and CTL will provide alternative sources of high quality diesel. The growth of these alternative fuels has been jeopardized by huge investments and by their impact on CO_2 emissions: however we may anticipate that these alternative fuels will contribute to the energy supply for transport sector in the next decades.

I remain cautious about the medium term prospects for the uptake of electric vehicles in view of the continuing difficulties in bringing to the market commercially attractive models. As well, the development of charging devices is still a challenge. So electricity may displace less than 200 kbd in 2035.

Oil substitutes development (NP and 450 PPM)



Source : WEC 2012

In a nutshell, in 2035 according to the IEA, alternative energy for transport sector way represents 8 Mbd in a reference scenario and 13 Mbd in a high case.
On the longer term beyond 2030, there will be a race between the ongoing growth of mobility demand driven by the economic growth and the increasing efficiency driven by technology. On the top of that there will be the substitute's effect. The result of this race on energy demand for transport sector and the related CO_2 emission remains highly uncertain.

Jérôme Ferrier

President

of the International Gas Union (IGU)

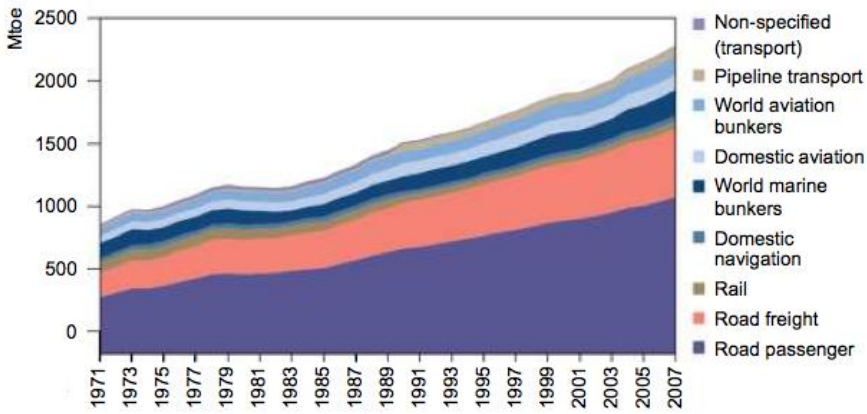
14 October 2013 - Future of transport: Decarbonizing growth

Natural gas and LNG: a part of the solution

The global transport sector consumes more than 2.2 billion tons of oil equivalent (Gtoe), representing about 20% of global energy supplies. Liquid petroleum products have been historically dominating the supply pattern, with about 96% of this amount in 2010, while the rest was from natural gas, biofuel and electricity.

More than 60% of the oil consumed globally-around 52 million barrels per day goes to the transportation sector. As this graphic shows, road transport accounts for the bulk of energy consumption, the light duty vehicles (LDVs) meaning cars, minibuses, and trucks representing more than half of the needs. Air and marine each account for about 10% of energy consumption while the railways for only 3%.

Global transport energy use by mode (Mtoe)



Looking at these shares over a long period of time shows that road transport, both for freight and passengers, has always dominated the sector, followed by aviation and shipping.

The transport sector is a major contributor to the global $C0_2$ emissions, although its 22% share is only half of the emissions from the electricity and heat sectors and slightly below that of industry.

In theory, using natural gas (CNG) and LNG, in a still unpredictable future hydrogen for fuel cells offer highly promising ways for reducing the carbon print in the transport sector. However, a series of factors are slowing dawn the process of conversion, among which:

- The relatively law energy density of these fuels when compared to conventional liquid petroleum products;
- The economic constraints, on a mass market like cars and light buses, for the renewal of the fleets, which has to be aligned with the depreciation and renewal rate of the vehicles, over a timescale that may exceed 20 years;

- The discrepancies in the GHG emission regulations in the transport sector on a global basis.

The energy density of natural gas under its CNG or LNG forms, although respectively 200 and 600 times higher than for methane at atmospheric pressure, remains much lower than in the case of diesel or gasoline. This is a natural handicap that has to be offset by providing a higher geographical density of supply points.

However, developing the necessary infrastructures for CNG, even in countries that already have natural gas transmission and distribution pipelines in place, is a long run process, which has to be fostered by granting the car manufacturers, the fuel distributors and the road users a visible and stable framework, in particular on the fiscal terms and conditions attached to the different options tendered for fuel vehicle supply.

For all the actors involved in the process, from the car manufacturers to the end users, the conundrum is "Natural gas is great but where do we get it, where is the infrastructure and can I depend on gas to sell cars or to purchase and run my new car?"
This explains that a process taking a lot of time when the fuel supply infrastructure is not at stake will take a much longer time if it means switching from one well known type of fuel to another one, although more attractive in terms of pricing and carbon print.

Another important factor is the regulation on quantitative CO_2 emission target levels, which presently vary considerably from one region to another. The car manufacturing market being globalized, it is essential for the development of CNG that such thresholds should be harmonized. It is a "chicken and egg" conundrum, although one would not dare using such terms for governments and regulators...

However, the intrinsic qualities of natural gas and, in particular, the importance of its reserve base (more than 250 years if we include shale gas), its environmental merits and relatively low price in comparison to oil, constitute a strong driver for CNG, as measured by various indicators.

Altogether, it is expected that the worldwide fleet of natural gas vehicles will continue its exponential growth during the present decade, with a total number of about 40 million units expected by 2015, which represents about 4% of the global light vehicles fleet.
A reasonable assumption, fostered by the abundance of gas resources and environmental awareness, is that NGVs might account for about 5% of the fleet by 2020, a figure slightly above IEA's estimates issued in 2011.

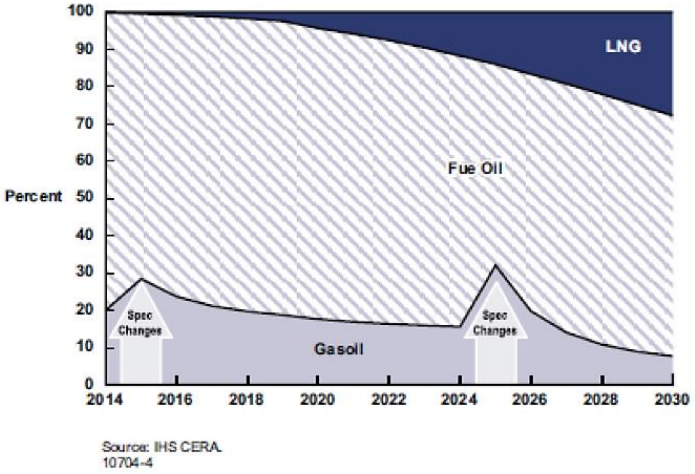
In the maritime industry, there is an increased interest towards the use of LNG as a fuel for bunkering, given its long-term availability, price levels and environmental impact. This is a new and highly promising sector for LNG in regions having LNG reception facilities.

As 2015 nears, the shipping industry is faced with adhering to much stricter regulations on sulphur emissions. Such regulation are now almost universal, they only differ in terms of target levels of $S0_2$ emissions.

At that time, the Emission Control Areas (ECAs) will enter into force. The ECA already comprises the Baltic and North Seas along with the English Channel, as well as the North American coast together with the US Caribbean. It will see the fuel sulphur limit fall to just 0.1% in 2015. From 2020, a global requirement of maximum 0.50% Sulphur outside ECAs shall apply.

LNG offers one of the most prominent and economic solutions, reducing sulphur dioxide, but also NOx and CO_2 emissions, while being economically feasible.

Potential shares of various bunker fuels in time



This graphic evidences the potential reduction of GHG and other atmospheric pollutants resulting from the switch from Middle Distillate Oil (gasoil) to LNG.

There are several options for future compliance with the ECA targets, mainly operating on low sulphur fuel oil or MDO, installing an exhaust gas scrubber on the ships or using LNG.

The DNV and large companies like Shell are projecting that, by 2030, up to 45% of vessels might be fuelled by LNG, the LNG bunkering option now seems a convincing alternative.

As in the case of CNG, the model implies the development of a network of LNG bunkering stations in the large harbours, as well as the need to establish a common regulatory framework for safe and sustainable LNG bunkering operations and related activities.

Altogether, many experts, like IHS CERA, foresee that the share of LNG among bunkering fuels could reach 20 to 25%, which appears as a game changer in the long-term.

To conclude, I will say that the abundance of natural gas reserves, now evaluated at more than 250 years of consumption, if we include unconventional resources, its more and more competitive pricing conditions as compared to petroleum products and its unquestionable lower carbon print has opened new avenues for its use in the transport sector.

However, although natural gas should not be regarded as a game changer across the board in the medium term, it obviously forms a part of the decarbonisation solution for the transport sector.

Philippe Cochet

President Alstom Thermal Power,
Executive Vice President Alstom

14 October 2013 - Panel "Energy and Climate Scenarios: The Business Implications"

As an introduction to our discussion I have 3 messages on the relation between Energy & Climate scenarios and business implications. I want to outline the need for a balanced energy technology mix, I want to share my confidence in technology evolution and finally I want to insist on the urgent need of long term stable policies - most business and political decisions are driven by the short term. We need to think beyond that.

First, on the energy and technology mix I strongly believe that a **diversified portfolio approach** is the only sound business and policy strategy able to address any Energy & Climate scenario. Excluding base fuels or technologies soon derails the objectives of the best intended policies, as exemplified by European power markets which have recently seen an unintended 2% increase in CO_2 emissions. Coal utilisation is increasing at the rate of **1.9% per year** (WEO 2012 – Current Policies – CAAGR 2010-2035) with reserves for over **100 years world-wide**[3] while nuclear remains the only fully dispatchable CO_2 free energy we have available and it can be made to operate safely. The stubborn fact is: **We need all the renewable and thermal solutions we have to address this century's energy Trilemma**.

That leads me to my second point: **Technology**. In recent years, we have seen an incredible rebound of the R&D spending in the energy sector, of which, I must confess, the innovation effort had been quite dormant since the nuclear wave of the 70's. For Alstom alone it is a +50% in R&D in the last 5 years, and we are keeping the pressure. This is leading to improvements in all areas:
First on efficiency: USC boilers operating at 300 bar/620°C reaching up to 46% efficiency, that's **30% less CO_2** emissions compared to the average world installed base[4] (The IEA estimated that around **60 GigaTonnes of CO_2 representing 2 years of world emissions**[5] could have been saved had all the new coal units built in the last 50 years always used the highest efficiency technology available at time of construction). Three CO_2 capture solutions now ready to be tested at large scale and a second generation solution in the pipeline, gas turbines breaking the 60% efficiency barrier, new plant service robotics to reduce down time and maintenance costs, 6 MW + offshore wind turbines, hybrid technologies for thermal solar, variable speed hydro pumped storage technologies, new tidal turbine technology, HVDC transmission and smart grids…just look where we were just 5 years back…

[3] Coal Reserves:
There are two internationally recognised methods for assessing world coal reserves. The first one is produced by the German Federal Institute for Geosciences and Natural Resources (BGR) and is used by the IEA as the main source of information about coal reserves. The second one is produced by the World Energy Council (WEC) and is used by the BP Statistical Review of World Energy.
According to BGR there are 1 038 billion tonnes of coal reserves left, equivalent to **132 years** of global coal output in 2012. Coal reserves reported by WEC are much lower - 861 billion tonnes, equivalent to **109 years** of coal output.

[4] Source: EPRI

[5] Source: IEA 21st Century Coal Report – October 2013

Progress is visible, on all fuels and technologies. That's the core of the credible answer of the power equipment sector to any Energy and Climate scenario. We remind governments that it is their role to support the demonstration and early deployment phase of new breakthroughs.

At Alstom, since 2002, we measure the CO_2 savings generated by the technology we install, according to a verified methodology (PWC). We are today exceeding **200 million tons of yearly CO_2 emissions avoided**[6], and 2/3 of this reduction is achieved by the deployment of state-of-the-art thermal power plants.

Finally, a short message to the many decision makers we have in this room. Energy is the sector with the longest economic cycles. Utilities invest for more than 20 years. They need to know what's happening. **Energy needs policy certainty and visibility and it needs players with strong balance sheets** to bear the huge investments and risks associated with energy production. I'm increasingly worried by the weakening of the balance sheets of our utility customers especially in Europe and North America. We see increasingly difficult project financing and permitting world-wide, uncertain regulatory and fiscal environment, incredible swings in regional fuel prices and availability, unintended policy consequences on power markets, (for instance in Europe we have **36% of the thermal capacity at risk of closure in the next 3 years**, **including the write-down of 26 billion euros of recently built gas plants, in America a recent analysis underlined a 55% decline in median valuations of coal-fired power plants assets**[7]. Compounding with these problems, the sector also needs to meet **new flexibility, grid stability and power storage requirements**. In some areas, the impacts of climate change are already being felt mainly in cooling or hydropower water availability…

So, please do what is your power to do: **give us long term Energy and Climate policies, give us a meaningful carbon price reference, and give us market and financial stability**. Most importantly, do not just wait for the outcomes of the upcoming COP meetings, it is now time for solid national commitments.

Thank you.

[6] Source: Alstom

[7] CERA Report - "Keeping Europe's Lights On, and Fitch Ratings "The Erosion in Power Plant Valuations", September 25th 2013

Gérard Mestrallet

Chairman and CEO, GDF SUEZ

15 October 2013 - "Shale gas and oil: is it just a bubble?"

As you are aware, the energy landscape has changed dramatically in recent years. I would describe it as a three-speed world.

In the first place, there is North America, and more specifically, the USA. We know how much the landscape has been modified by the intensive development of unconventional gas and oil. This has been a real revolution for the energy landscape and the world economy:

- The USA has become the world's leading natural gas producer – for the first time in six decades the country is a net exporter of petroleum products, and will soon be an LNG exporter.
- This is profoundly remodeling the entire American energy sector: there has been a marked shift to natural gas in the power sector, where the share of natural gas doubled between 2000 and today (from 15% to 30%), but also in the transportation sector such as for heavy trucks and for rail.
- Moreover, the phenomenon has affected the entire economy, by boosting USA's global competitiveness, with measurable impact on job creations and industrial relocations.
- At the same time, technological progress is helping to reduce the environmental impact of exploitation in terms of less pollution and a smaller land footprint.
- Furthermore, a new step is being taken with the acceleration of unconventional oil development.

The second group is emerging countries, where energy consumption goes hand-in-hand with their fast economic growth.

In the next twenty years, 90% of global energy demand will come from non-OECD countries.

To meet that increasing demand, all types of energy sources are needed: **coal**, **renewables**, and of course **natural gas**.

It is little known that 2/3 of the new demand in renewable electricity in the 5 coming years will come from non OECD countries.

As for gas, it is according to International Energy Agency the largest contributor to the new energy needs of emerging countries by 2035. This is not surprising, as it is at the same time an excellent combination of economic and environment efficiency (with reduced CO_2 emissions and local air pollution compared to other fossil fuels) and an opportunity to develop domestic resources for many developing countries.

The development of domestic unconventional gas resources in the emerging world could obviously speed up this trend in the coming years. The exportation of LNG from the USA directed towards Asia surely will…

I would like to underline that our strategy at GDF SUEZ is totally in line with this vision: fast-growing countries clearly are our number one strategic priority, where we want to develop the solutions which better correspond to the local resources and needs.

This has led us – for example – to be the 1st IPP in Brazil with 11 GW of hydro in production and under development, or to participate in a LNG liquefaction project in the US aiming at supplying the fast-rising Asian demand…

Lastly, there is Europe:

On the one hand, Europe's energy policy has failed an all three of its mainstays:

- the **environment :** The arrival of coal displaced by cheap US unconventional gas causes a rise in European CO_2 – only tempered by the economic crisis! And the CO_2 market is totally inefficient, as current market prices show;
- the **economy**, where there is a significant competitive gap with respect to the USA;
- and **security of supply**, which is jeopardized by the shutting down of gas-fired power plants. In fact, gas-fired power plants fail to find their economic break-even in a market where renewable electricity – wind and photovoltaic – continue to grow through subsidies regardless of the market needs. GDF SUEZ alone has already closed or mothballed almost 10 GW of gas-fired power plants in the past few years.

On the other hand, Europe is still hesitating about actively searching for its own unconventional oil and gas resource.

As a conclusion, I could say that shale is already a game-changer, starting in North America, but indirectly impacting the global energy landscape - in Europe and in Asia. Like all revolutions, this one has been pretty chaotic and right now is a difficult time for investors. Nevertheless, it will certainly be a long-lasting evolution.

The next question is: Will there be a shale revolution outside North America?

- There are still uncertainties with regards to resources, costs and the environmental conditions in which we could access shale gas – the USA benefited from an extremely mature and efficient industrial infrastructure, which facilitated the rapid development of shale gas.
- Also, part of the answer to this question lies with governments and with industry: their willingness to explore resources, and the need to set up a framework that provides guarantees to society and long-term visibility to investors, as well as to speed up technological progress.
- However, it is clear that shale gas provides a great opportunity, for the economy, climate change and global security of supply.

Jean-Marie Dauger

Chair of Communications Committee, WEC Senior Executive Vice President, GDF SUEZ

15 October 2013 - "Natural gas markets and geopolitics: a map in transition"

In 2010 nearly 1.3 billion people - close to one-fifth of the global population - did not have access to electricity. Moreover, almost the whole increase in global population - 1.8 billion people from 2010 to 2035 - will occur in the same areas currently deprived of electricity.

As a consequence, primary energy consumption in OCDE countries already achieved a plateau, and non-OCDE countries are expected to push for a vigorous growing energy demand in the coming decades.

How to provide, to all people, the energy needed to sustain or improve welfare will be a major challenge.

Energy efficiency must be part of the solution.

Energy requirements remain impressive and the consumption of fossil fuels is expected to increase in most scenarios!

Which energy mix shall be targeted is another issue.

All three fossil fuels are today well established, providing more than 80% of the energy required. But CO_2 emissions and air quality are gaining momentum, and public policies are also designed to prevent global warming and formation of hazes.

Renewable energies, when properly implemented, can be a sustainable solution, but their development will be progressive and not sufficient per se. The right balance has to be found, between, minimizing use of public funds (subsidies), enabling their efficient integration in the market design, and progressing on the learning curve to lower their cost.

Besides volumes, it must be recalled that renewable energies only provide electricity by intermittence, so that a cocktail is required with another energy.

More than ever, natural gas is expected to complement renewable energies in a lower-carbon economy, and meet the demands of sustainable development in our societies.

In only a few years' time, the shale gas "revolution" proved to be a success story in the United States. Gas production from unconventional wells currently amounts close to 40% of the total US gas production.

Its impacts on the gas markets are expected to be diversified and long lasting. Gas resources nearly doubled thanks to unconventional gas resources, up to 800 bcm – or 230 years of global consumption at the current rate.

For the United States, the shale gas "revolution" already has resulted into a very competitive access to energy:

- reinvigorating the US economy;
- making the US energy mix more environmentally friendly, both for air quality and CO_2 emissions as a result of gas natural substituting coal for the power production;
- even opening new sector such as the transport to natural gas.

Sooner or later, the production of unconventional gas will emerge also outside North America and Australia, with, potentially, likewise meaningful impact on the gas panorama.

Many of the current gas importers hold large unconventional gas resources.

If the impressive Chinese unconventional gas resources are successfully developed, gas will support dynamic domestic economic and energy growths, and double its share in the Chinese energy mix. It means that China's gas consumption could eventually grow 3 to 4 folds, and reach by 2030 an equivalent of the European gas market.

Timing and extent for a generalized use of unconventional gas remain, however, uncertain. Resources are generally assessed with only limited data and do not always translate into developed reserves.

A combination of favorable factors enabled shale gas to be a success story in the US:

- A favorable geology
  - according to the oil & gas industry standards
  - concentrated in sparsely populated areas, enabling drilling intensity
  - and well appraised after decades of exploration, research and development
- Abundant water resources
  - in line with the need of the process to produce shale gas
- A widespread pipeline network
  - minimizing the problem of stranded resources
- A unique system of property rights
  - prompting the local population to develops the underground resources.
- A world-class oil service industry
  - with technically skilled workforce, and the required rig forces, which is noteworthy since unconventional developments are drilling-intensive.
- A well-accepted learning-by-doing, trial and error modus
- A capital markets structure that is used to financing exploration risks
- Gas market prices, correctly reflecting the value of gas, incentivizing the private sector

All those conditions will not duplicate outside US. Each zone will have to define its own way to benefit from the unconventional gas potential.

But shale gas has also a major impact on the gas map: US are becoming an LNG exporter by the end of the decade.

A significant part of US volumes may be sent to Asia Pacific, since Asian companies are keen to diversify their supply portfolio in terms of location and price indexation (HH indexation).

The impact on gas trading may be significant but the magnitude of its consequence on LNG pricing mechanism is still uncertain.

Marie-José Nadeau

WEC Chair *

15 Octobre 2013 - Concertation ministérielle francophone : vers un nouveau modèle énergétique

Monsieur le Président de la Conférence,
Monsieur le Ministre des Ressources naturelles du Canada,
Madame la Ministre des Ressources naturelles du Québec,
Distingués invités,

C'est avec beaucoup de plaisir que je me joins à vous aujourd'hui. L'initiative de cette conférence - vous vous en souviendrez - remonte à 2010, à Montréal dans le cadre du congrès du Conseil Mondial de l'Énergie. Trois ans plus tard, nous nous retrouvons au cœur de l'Asie pour un deuxième rendez-vous. Je ne peux vous cacher le plaisir que j'éprouve et ma fierté, en tant que Montréalaise et Présidente du Conseil Mondial de l'Énergie, de reconnaître un forum francophone au sein de notre organisation et de lancer les travaux de votre deuxième conférence.

Si, en 2010, vos échanges ont porté sur l'accès à l'énergie dans une perspective de développement responsable et accepté par les communautés, les discussions que vous aurez à Daegu se feront certes dans la continuité mais dans un contexte de complexité accrue.

En effet, nous sommes confrontés à des enjeux de plus en plus complexes et l'incertitude qui en découle a augmenté.

Les décideurs sont appelés à faire des choix difficiles et lourds de conséquence.

Fort de notre réseau de 93 pays membres et des 3 000 organisations et experts participant aux travaux du CME, nous avons dressé le portrait des grandes tendances qui marqueront le secteur de l'énergie d'ici 2050.

- Si on peut se féliciter de percées technologiques et de l'innovation dans le domaine de la production d'énergie et de la protection de l'environnement, on doit néanmoins reconnaître l'impact des émissions accrues de GES et les conséquences des changements climatiques sur la planète. Les grands désastres naturels des dernières années sont venus donner un sens très concret aux dommages que peuvent causer les changements climatiques. Aucune région n'est à l'abri de ces phénomènes climatiques extrêmes : pays industrialisés et pays en émergence sont sur le même pied. Les inondations et les grandes sécheresses sont observées dans tous les continents.

- L'énergie, qui compte pour les 2/3 des émissions globales de GES, est à l'avant-scène des responsables et par conséquent, du défi.

- Ceci dans le contexte où, sur une population totale de 7 milliards, il y en a 1,1 milliard qui vit sous le seuil de l'extrême pauvreté et un autre milliard sans accès à l'électricité, ni à de

* Marie-José Nadeau a pris effectivement la présidence du Conseil Mondial de l'Énergie à l'issue du Congrès.

l'eau potable. On prévoit que la population mondiale va croître d'un autre 1,6 milliard d'ici 2035, en très grande partie dans les pays en émergence.

- À l'échelle mondiale, à l'horizon 2050, la demande en énergie croît de façon significative en raison de la croissance de la population, de l'industrialisation des économies émergentes et de l'augmentation de la demande dans les pays industrialisés, et ce malgré les gains en efficacité énergétique.

- Nous observons un déplacement des profils énergétiques des pays industrialisés vers les économies émergentes.

Dans ce contexte, le CME a souhaité enrichir le débat en rendant publiques dans le cadre de notre congrès deux études majeures et novatrices.

La première étude s'intitule : le trilemme énergétique mondial (*The World Energy Trilemma*) ou comment réconcilier les objectifs de sécurité énergétique, d'accès à l'énergie et de développement durable ?

- Cette étude analyse la dynamique entre les décideurs politiques et industriels, et établit entre eux un dialogue sur la question suivante : comment développer une énergie fiable et abordable, compatible avec le respect de l'environnement et la croissance de nos économies ?

- La réponse à cette question varie, bien sûr, d'un pays à l'autre en fonction du niveau de développement, des ressources naturelles disponibles et des contextes politique, économique et social.

- Les intervenants politiques et industriels conviennent de la nécessité d'agir, mais ils sont profondément divisés sur la nature des interventions requises, l'évaluation des risques politiques et institutionnels et leurs impacts sur les investissements.

- D'une part, les leaders industriels en appellent aux gouvernements pour qu'ils :

    1. adoptent des politiques énergétiques cohérentes et prévisibles ;
    2. mettent en place un cadre réglementaire et juridique stable et propice aux investissements à long terme ; et
    3. encouragent les initiatives publiques et privées qui permettent l'innovation, soutiennent la R&D et les projets de démonstration.

- De leur côté, les gouvernements s'attendent à ce que l'industrie s'engage plus activement dans l'amélioration des politiques énergétiques et le respect de l'environnement tout en étant plus proactive dans le partage des connaissances et des expertises.

La deuxième grande étude que nous avons menée porte sur des scénarios énergétiques à l'horizon 2050 (*World Energy Scenarios for 2050*)

- Un premier scénario fait l'hypothèse de plus d'interventions de la part des gouvernements, particulièrement dans le dossier des changements climatiques ; c'est le scénario Symphonie. Un deuxième scénario fait l'hypothèse d'une plus grande autonomie des marchés et d'une croissance économique fondée sur une énergie moins coûteuse ; c'est le scénario Jazz.

J'attire votre attention sur les points de convergence de ces scénarios.

- Dans les deux cas, il ressort clairement que:

1. À l'échelle mondiale, la demande augmente de façon importante et excède l'offre; nos études anticipent que 50 % de cette croissance se produira en Asie et environ 15 % se concrétisera en Afrique (incluant le Moyen-Orient).

2. Le mix énergétique sera principalement composé d'énergies fossiles. En termes absolus, à l'horizon 2050, les énergies fossiles (pétrole, gaz et charbon) représenteront, selon le scénario retenu, entre 77 % (Jazz) et 59 % (Symphonie) de la consommation globale d'énergie. Les énergies renouvelables passeront de 15 % à 20 % (Jazz) et à 30 % (Symphonie) ; elles sont en progression, mais elles ne suffisent pas à combler la demande.

3. La contribution de l'efficacité énergétique est indispensable dans un contexte d'une demande plus importante que l'offre. À l'horizon 2050, les gains en efficacité énergétique sont importants. L'énergie consommée en fonction du PIB diminue d'environ 50 % dans les 2 scénarios. Mais les gains futurs font appel à des changements dans les habitudes de consommation et à des investissements coûteux.

4. À défaut de reconnaître le coût ou la valeur du CO_2, l'économie mondiale peinera à respecter la limite de 450 ppm d'émissions de dioxine de carbone dans l'atmosphère, avec les changements climatiques qui y sont associés.

5. Les technologies permettant la capture, le stockage et l'utilisation du carbone (CCUS) sont indispensables, tout comme l'énergie solaire et le développement de technologies de stockage de l'énergie.

6. Investissements, intégration régionale et efficacité des marchés de l'énergie sont indissociables, particulièrement en Afrique ; et

7. Les politiques énergétiques doivent stimuler l'efficacité des 2 marchés : celui de l'énergie et celui du carbone.

Sur la base de ces tendances, quels sont donc les mythes qui sont véhiculés et quelles sont les réalités correspondantes ?

Mythes et Réalités

1. Le mythe : la demande va se stabiliser avec le temps.

C'est faux. La demande continue d'augmenter en raison de la croissance des économies émergentes dans les pays non membres de l'OCDE. On prévoit que la demande en électricité pourrait doubler d'ici 2050.

2. Le mythe : les ressources fossiles sont appelées à se tarir.

C'est faux. Il n'y a pas de pénurie en vue. L'innovation technologique nous permet d'accéder à des énergies fossiles conventionnelles et non conventionnelles telles que le pétrole et les gaz de schistes et les sables bitumineux. On évalue que les réserves d'énergies fossiles sont 4 fois plus importantes qu'estimées et que ce facteur est appelé à augmenter avec l'innovation technologique.

3. Le mythe : les énergies renouvelables vont suffire à combler la demande.

C'est faux. Nos études révèlent que la demande augmente malgré la contribution des énergies renouvelables qui sont appelées à passer de 15 % globalement à 20 % ou 30 %, selon le scénario retenu. De toute évidence, elles ne suffiront pas à combler la demande.

4. Le mythe : on peut réduire les émissions de GES de 50 % à l'horizon 2050.

C'est faux. Nos études démontrent que dans le meilleur des cas, les émissions vont presque doubler par rapport à l'objectif qu'il faudrait atteindre en 2050 pour éviter des conséquences irrémédiables sur le climat. Dans le pire des cas, les émissions pourraient quadrupler à cet horizon.

5. Le mythe : les modèles d'affaires et de marché en place aujourd'hui sont adéquats.

C'est faux. Nos analyses démontrent que les marchés de l'énergie sont de plus en plus complexes, en grande partie à cause de l'instabilité des politiques énergétiques, de l'innovation technologique et des attentes des consommateurs. Dans bien des pays, les modèles d'affaires en place ne sont pas efficaces pour gérer l'impact combiné des énergies renouvelables sur les réseaux de transport, des systèmes de distribution décentralisés, ou encore des architectures technologiques de plus en plus sophistiquées et fortes consommatrices d'électricité.

6. Le mythe : les programmes actuels suffisent pour que la population de la planète ait accès à l'énergie d'ici 10 ou 15 ans.

C'est faux. Tout en reconnaissant les gains faits récemment, particulièrement en Chine et au Brésil, nos analyses démontrent qu'à l'horizon 2030, une population variant entre 730 et 880 millions sera toujours privée d'accès à l'électricité et qu'à l'horizon 2050, cette population variera entre 320 et 530 millions.

7. Le mythe : il n'y a pas de problème d'accès au capital.

C'est faux. Le capital privé est extrêmement sensible aux risques politiques et réglementaires tels que perçus. En outre, en raison des pressions sur les finances publiques observées dans plusieurs pays, les fonds publics ne sont pas disponibles pour remplacer ces capitaux privés frileux.

Ce sont des constats déprimants, pensez-vous ? Ce n'est pas la conclusion qu'il faut retenir. Cela nous fait réaliser l'ampleur des défis et la complexité des enjeux. Cela met aussi en évidence les responsabilités incontournables des pouvoirs publics dans l'élaboration des politiques qui sont requises pour réconcilier les objectifs d'accès à l'énergie, de sécurité énergétique et de protection de notre environnement.

Vous me permettrez de citer le Secrétaire général des Nations-Unies, Ban Ki-moon, qui a fait l'analogie suivante : « l'énergie est le fil doré qui relie la croissance économique, l'équité sociale et le respect de l'environnement. »

Renoncer aux politiques de court-terme et développer un cadre législatif et réglementaire soutenant les investissements et la croissance et favorisant l'équité sociale dans le respect de l'environnement représentent un défi de taille.

C'est un défi qui nous interpelle tous.

Mesdames et Messieurs, je vous souhaite des échanges fructueux et instructifs.

Jean Eudes Moncomble

Secrétaire général du Conseil Français de l'Énergie

15 October 2013 - Effective International Governance on Nuclear

As an introduction, Jean Eudes Moncomble, moderator of the session, recalled that in WEC Scenarios to 2050, nuclear energy will contribute approximately 4% of total primary energy supply in Jazz in 2050 and 11% in Symphony – compared to 6% in 2010.
More precisely, there is an increase of nuclear capacity (even in Jazz, thanks to demand increase) from 373 GW in 2010 to 481 GW (Jazz) or 884 GW (Symphony) in 2050.

The conditions to such a development are well known. One of them, a *sine qua non* condition, is safety and one way to improve safety is governance improvement.

In the post-Fukushima debate, many questions have been raised on how to improve global governance on nuclear safety which is considered as a sovereign issue in all countries. National boundaries are meaningless in the context of nuclear accidents. However, current nuclear governance rests with nation states, with a limited level of oversight by the international organizations. There is a clear and critical need to strengthen the global governance of nuclear energy.

Five high-level speakers have contributed to the discussion. The first talk of each speaker was dedicated to the following question: what is the right balance of sovereignty versus global governance in nuclear safety?

Yukiya Amano, Director General of International Atomic Energy Agency, confirmed that global use of nuclear power will continue to grow in the next few decades despite the Fukushima Daiichi accident. Many countries are interested in nuclear power to improve energy security, reduce the impact of volatile fossil fuel prices, mitigate the effects of climate change and make economies more competitive.

The number one challenge is safety. The most robust levels of nuclear safety, based on IAEA safety standards, must be implemented at every nuclear power plant in the world.

Nuclear safety has always been a national responsibility. But the Fukushima Daiichi accident is a reminder: nuclear safety transcends borders; that is why more effective international cooperation is vital. The IAEA will play the leading role in shaping a worldwide safer nuclear future.

It is vital to ensure that the expansion of nuclear power does not lead to the proliferation of nuclear weapons. All countries should conclude and implement comprehensive safeguards agreements and additional protocols with the IAEA.

Hasan Murat Mercan, Deputy Minister of Energy and Natural Resources of Turkey, has given a very interesting point of view both from a political and academic perspective (he is a professor), mainly focused on national examples, including Turkey.

One of his stronger messages is that there is no risk of contradiction or inconsistency between international and national governances when the real objective of nuclear development is energy

generation. Concerns appear when expansion of nuclear industry is oriented toward no pacific objectives.

Agneta Rising, Director General of the World Nuclear Association, has presented WNA approaches to governance and elaborated whether a global approach is effective. She has underlined that lessons from other industries could be useful and advocated for a global recognition for good national governance. She has insisted on the necessity to work with international partners on both safety and the safety issues 'communication.

Jacques Regaldo, Chairman of the World Association of Nuclear Operators, has provided a perspective on what is WANO. It is WANO's essence to foster international cooperation among nuclear operators worldwide, assuming that safety depends on each one of them. WANO was created after the accident of Chernobyl, as the world's nuclear operators realised that an event at one plant would impact every plant. WANO's mission is to maximize the safety and reliability of nuclear power plants worldwide by working together to assess, to benchmark and to improve performance through mutual support, exchange of information and emulation of best practices. Although membership is not mandatory, and leads to strong commitments at the highest level (CEOs), all civil nuclear operators, without exception, are WANO members.

Fukushima accident strongly impacted the nuclear community including WANO, who also had to question its positioning and scope of activities. Five new strategic orientations have been decided to strengthen WANO's role, aiming to bring a more consistent, transparent and integrated response to the nuclear operators. WANO's peer review process, which constitutes its core-business, has been intensified including corporate and pre-start up peer reviews and, for Japanese plants, restart reviews. WANO also decided to expand its scope of activity in order to include elements of design, based on the principle that the role of a nuclear operator is not only to operate safely, but also to be sure that the plant itself is safe.

It is in WANO's DNA to cooperate strongly at both regional and international levels with all international safety organizations (WNA, INPO, JANSI etc.) including those working at a state level (IAEA, regulators). Safety requires continuously improvement but also that no operator feels isolated, or refuses openness and permanent self-questioning; it requests as well for WANO to ensure that cultural and sometimes economic and political barriers do not hinder safety culture – the accident of Fukushima is from this perspective highly instructive.

In some way, the main target of WANO is to identify the most in-need operators, whatever the reasons are, and to provide them with the most accurate support. Therefore, WANO pays a particular attention to potential newcomers.

WANO believes that management system and practices are at the center of safety culture, and a full involvement of top management (CEOs) is absolutely requested. Through its commitments and rules (an escalation process exists if obligations are not met), WANO pressures its members and helps them at reaching the highest possible standard of safety.

Didier Cordero is EDF Asia Pacific Branch, Executive Vice-President. He started his carrier in the EDF direction "Nuclear Engineering" where he participated in the construction of several plants in France and China. He is also advisor to the Foreign Trade at the Ministry of Foreign Trade. As other French speakers, his speech is published on page 58; so you can read his opinion as he expressed it during the Congress.

Following these first contributions, some complementary discussions dealt with the composition of the panel (no National Safety Agency, no equipment company) and with safety concept.

Reading the Congress Newspaper, Jean Eudes Moncomble quoted an article of Hwan-Eik Cho and Pierre Gadonneix:

"Examples of successful global governance can be found in many industries and may provide models for the nuclear power industry. The aviation industry, for example, has many similarities with the nuclear industry since both have competing designers, manufacturers and operators, all of whom work under national authorities. Yet, the aviation industry uses international certification standards to ensure airworthiness as well as protocols for navigation systems and other aspects of operation. Aircraft safety is no longer a factor in the competition between manufacturers: competition works on other criteria."

The discussion went on these issues and everybody agreed on the interest to share experience with other industries, even if each industry characteristics are quite specific. A few words were said about what could be a pragmatic approach: global high level agreement or gradual process? Top-down or bottom-up processes?

It was difficult to conclude, however some key messages were clear:

Coming back to the beginning of the session, it was repeated that safety was a *sine qua non* condition to nuclear development. Safe nuclear is a part of the answer to WEC Energy Trilemma. Nuclear is safer now than before, thanks to international cooperation, however there is no place for complacency. We need better, smarter governance - this will promote safe operations and help to achieve the necessary expansion of nuclear generation. To do so, we have to associate all stakeholders, including operators. The pragmatic way to improve nuclear governance could be a process which begins by setting international standard beyond the larger countries/companies.

Delegates listening to the discussion leaders at the World Energy Congress © WEC

Didier Cordero

EDF

Asia Pacific Branch, Executive Vice-President

15 October 2013 - Effective International Governance on Nuclear: What does it take from the operator point of view?

The nuclear industry is not a dormant one and has profoundly evolved during the last 15 years.

31 countries are operating nuclear power plants in the world. In 2012 the production of nuclear electricity amounted to 10% of the world electricity consumption and some countries are actively pushing nuclear ahead.

Nuclear has a bright future, in particular because this is the only way, except hydraulic, to make electricity in base load without carbon emission. But, to do so, it has to be safe and efficient.

To make an organization efficient, the responsibilities have to be allocated clearly.

- The definition of a national nuclear program is the responsibility of the State.
- The operator is responsible for the definition and implementation of the safety measures on its fleet.
- And finally the State entrusts the safety authority to approve and control the means defined and implemented by the operator.

Transnational organizations exist at each level of this organization: at the State level (IAEA), at the Safety Authorities level (WENRA) and at the Operators' level (WANO).

To make a plant safe, the operator must control design, construction, procurement, operation of its facilities. This is the pattern of the Architect-Engineer model EDF developed.

Dealing with unprecedented situation happens every day in industrial facilities. When something unplanned arises, or when exceptional events occur, the operator has to fine-tune both its facility and its organization. To do so, **it analyzes the widest possible feedback**.

Then, it deduces the measures to be implemented to continuously improve the safety and performance of its facilities

In France we, EDF, collect the feedback of experience from minor and major events, on our fleet and internationally. To do so, we participate actively in international organizations like WANO and we implemented many cooperation agreements and twinning programs with foreign operators.

Then, EDF engineering teams analyze the feedback, design the improvement, order from the suppliers the necessary services and equipment and implement them in the plants under operation, construction and design. **This is the principle of the progressive standardization process,** according to which all the plants of the operator offer **the same safety standards, whatever their age and technology**, while maintaining the economics competitive advantage of the nuclear.

So to sum-up:

- We need a 3 layer governance with clear responsibilities allocation: the States level, the safety authorities and the operators.
- There is a way to continuously improve the safety and the performance. It is, for the operator, to collect the widest feedback of experience – to do so we need organization and governance as WANO –, to implement the improvement in all its plants under operation, construction and design. Doing so, all the plants of the operator offer the same safety standards, whatever their age and technology.
- To reach the highest safety level, the capacity of the operator to implement such a continuous improvement is far more important than the accumulation of technologies.

Delegates and media gathering at the opening ceremony © WEC

Jean-François Cirelli

Vice Chairman and President, GDF SUEZ
President, Eurogas

16 October 2013 - Europe's different agendas: Steps to an effective European energy market integration

Market integration, anywhere, is always a challenge. But the more policies and tools remain at a national level, the higher the challenge is. Unfortunately, we clearly notice the increasing strength of local policies in Europe today. The crisis has emphasized this situation, which has to change quickly, if we want to succeed market integration.

Companies still believe in the objectives of the EU policies, which aim at building integrated markets for the benefit of all stakeholders. Several means to increase integration exist. The main objectives of the three Energy Packages (1998, 2003, 2009) – unbundling, market price liberalization, creation of new regulators, development of trading activities – have been reached along the last ten years. The 3X20 action in 2007, that was a political call, in which all of us have believed, was a successful first step in that direction. Many actions have already been successfully implemented, which are now part of the market coupling.

On one hand, new gas hubs and pipelines (Nord Stream, Nabucco) are many opportunities of new developments for the energy markets. Many significant investments have been launched in the field of interconnections, and some others are still in progress. Between 2005 and 2012, Europe has invested yearly between 3 and 8€ Bn in power infrastructure. The interconnection between France and Spain expected in 2014 will double the exchange capacity from 1,400MW to 2,800MW. In addition, two cross-border interconnections, which represent 500 MW, were commissioned in 2012 and 2013 in Ireland and the UK. All that are evidence that many successes have been reached in the past few years on the way toward an effective market integration.

On the other hand, a lot still remains to be done today by the European energy policy makers. The question of prices has appeared after the crisis, as prices become more and more a clue for end consumers. Although liberalization is a good policy, it means for them higher prices, and that is not so obvious to be understood. That could be illustrated through many examples. Despite a downward demand in 2012, both gas and power prices have significantly risen across Europe (respectively 10.3% of rise for residential gas prices since 2011 and 5% of yearly average rise for power prices since 2011). Spain, Portugal and Poland have joined Germany, Hungary and Slovakia in the group of countries experiencing highest residential prices, around 250€/MWh.

The consequences of the development of renewables have not been taken into account in the right way in Europe, in particular impact on prices and ability to address peaks or intermittency. In Germany, for example, weak demand over the last Christmas break, due to milder than usual temperatures, combined with a high renewable production, made prices go down under 0€/MWh. In France, high French hydro, renewable development and nuclear availability throughout the second quarter of 2013 made the power prices drop.

What are the next steps when we know that environmental targets will be difficult to meet? According to the European Environment Agency, only France, Germany, Denmark and Bulgaria will meet the 20% energy efficiency goal by 2020. In the meantime, the decrease of coal price (minus 19% from the end of 2011 to the end of 2012) contributes to the coal revival.

In addition, there is no real convergence of national energy mixes in Europe. There is, for instance, no common point between the French energy mix (around 80% of power production from nuclear) and the Polish one (around 90% of coal power generation from coal). We have not succeeded in correlating energy market prices in the countries of the Copper plate. In the first half of 2013, German prices have been traded in the meantime with a 20% discount to Dutch prices and with a 10% discount to French prices. Even more, we notice since the crisis of 2008, the return of fragmented national energy policies, and an increasing willingness of countries to act on their own. That is a major threat for us, who are fully European actors.

So, today, the most important for us, as utilities, is to raise the awareness on the situation to our policy makers. That is what we are currently trying to do in Europe through our instances Eurelectric and Eurogas. The place of gas in the future in Europe depends on the answer. The current policies are leading to a “no gas policy” in Europe; which is detrimental for this continent.

The evolution of the support schemes dedicated to renewable combined with energy efficiency could also reinforce the competitiveness of energy prices. In Germany, the portion of the EEG tax funding the renewable energy capacity development has increased from 36€/MWh in 2012 to 53€/MWh in 2013 (around 20% of the total electricity price for household). According to the BDEW, all taxes and duties are expected to exceed a 50% share of the German household bill for the first time in 2013.

Security of supply also reaches higher and higher stakes, comparatively to the last decade, and leads to the question of capacity remuneration schemes in Europe. As an example, 15.8 GW of generation capacity were decommissioned in 2012. As utilities, we need to get the best harmonized schemes as possible but this is still not the case. Shale gas remains a topic non tackled despites reserves (around 13.2 tcm estimated to be technically recoverable in Europe in 2012 – meaning less than one year and half of European consumption).

Many suggestions have been pushed by European industry players to reach market integration: reinforce renewable to reach environmental targets, increase coordination between States to avoid counterproductive individual actions (energy mix, regulation), clarify and stabilize regulatory/market framework for private investments, develop power interconnections and gas hubs. The European Commission estimates that 100€ Bn investments are at risk of not being realized due to delays in permitting procedures, access to finance and lack of adequate risk mitigation mechanisms.

To conclude, we are today at the crossroad of many key issues that remain to be dealt with: security of supply, innovation, gas policies, investments of the different companies in the next ten years... the European Commission has defined that 210€ Bn investments are required by 2020 (140 for power, 70 for gas). For the time being, there have been many investments made in Europe for the past decades, but today nobody is anymore prepared to invest in Europe. The major threat today against the policy for European integration, is how the sector could again be investible.

Pierre Gadonneix

WEC Chair

16 October 2013 - Ministerial dialogue: Energy in Transition

Ministers, Ladies and Gentlemen, Distinguished Guests,

It is a great honor for me as Chairman of the World Energy Council, to welcome you all today in Daegu, for this Ministerial Roundtable. In this room today are gathered some of the world's most influential government leaders and policy-makers, and I am delighted that we will have this opportunity to hold a frank, open, off the record dialogue, **to discuss the most important energy issues and challenges that our countries and indeed, the world, face today.**

These issues and challenges are also the key topics of our congress, but this is indeed a unique opportunity for you, who are responsible for setting the policies which will determine our energy future and help secure tomorrow's energy today, to debate, discuss and challenge and to make the most of the gathered expertise and experience in this room.

I feel sincerely privileged to be the co-host of this event with the Minister of Trade, Industry and Energy, Mr. Yoon, Sang-jick, and I want to express my personal thanks to Mr Yoon not only for co-hosting this important Ministerial session but also for his Ministry's support of the 2013 World Energy Congress.

It is a pleasure to be in such an exciting place as South Korea when it comes to energy. South Korea is the world's 10th largest energy consumer with virtually no domestic energy sources of its own. It imports 97% of its energy resources, and is currently the 6th largest oil importer in the world, and the second-largest importer of liquefied natural gas in the world behind Japan. To reduce its energy dependency on foreign fossil-fuels, the Korean government has promoted the domestic development and use of new and renewable energies. **Korea has something to say in the global debate on energy public policies.**

South Korea is the world's fifth-largest nuclear power producer. Nuclear power in South Korea already supplies 45% of electricity production. But the country is very active in research, and contributes notably to the long-term ITER project on fusion energy, which is hosted in France, one of the project-partners. South Korea is also a successful exporter of nuclear reactors worldwide. New renewable energies are currently being developed. The wind power industry, especially offshore, is growing quickly thanks to Korea's steel industry and open access to ocean wind.

What is more, South Korea has emerged as a key player in the fields of innovation as regards smart technologies and future grids. **Korea has, again, something to say in the global debate on energy resources and technologies.**

But it is not just Korea we will hear from today. Every one of you also has much to share with respect to policies that your countries are developing and implementing to address the constantly growing increase in energy demand, the need to ensure security of supply, the challenge of finding ways to provide energy to those people in the world who either do not have

access or cannot afford it; and the need to discover innovative ways – whether through technology, energy efficiency or other means – of mitigating climate change. These challenges form the basis of WEC's energy Trilemma work, and our 2013 report, which was released two weeks ago in New York.

In addition, we will release at this Congress two other important WEC studies: our latest work on energy policy scenarios, which is aimed at helping policy-makers and decision-makers understand how the choices we make today will impact the future; and the World Energy Resources report, which the World Energy Council has published since 1934, and which provides data on reserves and resources for nearly 20 energy sources.

In this Ministerial Roundtable, we will focus on two topics: "Balancing the Energy Trilemma", in which we will have the chance to **discuss** the big hurdles for governments to overcome to meet the challenges of the energy trilemma, to **debate** how to attract the required investment in energy infrastructure to support the trilemma and **to dialogue** about possible solutions from both the national and international perspectives. I am sure we can look forward to a very robust discussion of the issues.

The 2013 World Energy Congress here in Daegu constitutes a unique opportunity for you – the energy ministers, development bank representatives and top policy-makers from around the globe -- to share your insights in terms of future energy developments, to promote actions to be taken to work toward a sustainable energy future and to initiate improvements in international and national governance and cooperation at a time when the context is urging us to act! The challenges we face call **for urgent, intelligently designed and coordinated actions on our part. Energy is no longer just a national issue – it is a global issue and it is through the kinds of global dialogue, debate and discussion which the World Energy Council works to facilitate that we can – together – find the solutions necessary to secure tomorrow's energy today.**

Thank you!

Pierre Gadonneix, WEC Chair - Korean Minister of Trade, Industry and Energy Yoon Sang-jick – Marie-José Nadeau, WEC incoming Chair © 2013 NewsWorld

Bruno Lescoeur

Senior Executive Vice-President Gas Southern Europe, EDF

17 October 2013 - Sustainable energy for all

I am speaking this morning on behalf of Henri Proglio, the CEO of the EDF group, who was unexpectedly kept in Europe and could not travel to Daegu today. He regrets he could not be with us, and I will deliver the messages that he and the EDF Group wish to share with you. Let me express my, our gratitude to the warm hospitality and the great organisation of our Korean hosts; let me also thank the WEC, its outgoing and incoming chairs, and all colleagues for a great programme, with diverse and good discussions.

Let me start by saying that our discussion today on Sustainable Energy For All well fits the core of the Daegu debate. Allowing for a secure energy supply to all, requires investing in new policy frameworks, in new technologies and in new projects today. The myth of flattening demand, the myth of easily reaching full energy access, the myth of having secured our climate security have correctly been challenges by Sunday's' WEC statement. Here we have a good opportunity to elaborate on the call for a comprehensive, multilayered action that can deliver the successes that we need.

For the emerging countries, access to energy is not a philanthropic question, it is a development issue. The stake for these countries is not to distribute eco lamp bulbs in remote areas but to have a State industrial vision according to which their energy plan, including electricity, will serve and benefit national development goals.

The three layers that co-exist in emerging countries have to be taken into account:

- extreme poverty, as energy is a major element to consider when talking about health system, education and food supply;
- areas under-development, that need financing, international cooperation and governance progress;
- and finally industries, urban centres and social groups that have already access to development and who need, to remain at this level and to keep going further, innovation, advanced technologies and efficient regulations.

This approach is now taken into account globally as energy, which was not part of the Millennium goals, will be taken into account in the objectives which will be implemented starting from 2015 to replace the Millennium goals. Energy is therefore now recognized as a major stake to achieve sustainable development.

In the coming decades, the development of energy consumption in emerging countries will continue to rely heavily on fossil fuels, increasing pressure on these resources as oil reserves diminish and making necessary the development of advanced coal-technologies and a stronger emphasis on gas-fired facilities.

Therefore, sustainable energy for all is not only a question for emerging countries but also very much a question for developed countries. The French energy transition for example translates into the stabilization of the French energy mix.

Nuclear has an important part to play in reaching this goal, as it provides competitive, safe and CO_2 free electricity, on a long-term, 40 to 60 years basis.

The development of renewable energy is fast. In 2011, Europe was leading, since its 80.6 billion euros of investments exceed the cumulative investment in the United States (39€ billion) and China (37€ billion) in the same year. However, adding capacity powered by renewable sources cannot be an end in itself. The intermittent power must be considered in an integrated manner, taking into account the local context and with the objective of overall effectiveness of regional systems of power generation. It is extremely useful when backed by storage, which can be achieved through several means already available, such as pumping, water heating, charging batteries. It is also important where it can contribute to base generation given the local weather situations, as may be the case in the United States.

In this perspective, distributed energy is meant to become an important part of the future global energy mix.

Competences and capacity building will also be an important part of the future energy landscape and will require intense international cooperation. When we operated only coal fired plants it was easy because the fuel supply was there, but also because we had people who knew how to build and operate the technology. Today the technologies are more complex and the integration of fuel supply security, infrastructures development, networks optimization, and regulatory framework design, require more knowledge and more diverse skills.

Sustainability considerations are becoming part of the financing models of the new energy developments. Banks like the World Bank and the Asian Development Bank, but also more specialized institutions such as the Green Climate Fund, based in Korea, integrate green criteria in their projects' evaluation process and illustrate that sustainability can make energy projects attractive for developers.

Sustainable energy for all can only be achieved through a comprehensive, holistic approach. Energy Access requires a multilayered strategy, starting on the territory with specific local solutions, but requiring solid frameworks to trigger larger scale national and supra-national investments. There is no local success without triggering broader actions and investments; let me for example quote the EDF Group success story on the Nam Theun 2 project, a one thousand seventy Megawatts hydro power station, which required world-class competencies and massive resources, in order to achieve a large scale, regional benefit in terms of sustainable, secure and affordable energy. This is an example of why these challenges require stable frameworks and extensive risk-mitigation tools that policies shall offer. As this discussion in WEC well shows, the industry and our companies are ready to engage, both in a solid stakeholder dialogue with policy-makers and in what we can do best: invest on making energy access secure and available to our communities. Sustainable Energy Access, finally for All.

François Moisan

Directeur exécutif de la Stratégie, de la Recherche et de l'International, ADEME

17 Octobre 2013 - Efficacité énergétique : comment exploiter le potentiel d'efficacité énergétique ?

Il existe un large consensus des professionnels de l'énergie pour reconnaître les bénéfices multiples de l'efficacité énergétique (baisse des factures énergétiques et gains compétitifs associés, amélioration de l'indépendance énergétique, lutte contre le changement climatique, création d'emplois, etc.). L'efficacité énergétique est un des leviers majeurs de la transition énergétique et est rentable financièrement et économiquement. Cependant, si le potentiel d'efficacité énergétique est important, les progrès observés sont lents. Il existe de nombreuses barrières à l'efficacité énergétique comme la disponibilité des capitaux (accordés prioritairement aux investissements productifs), les incertitudes technologiques, l'absence de signal-prix incitatif du fait des subventions au secteur de l'énergie, la complexité du comportement des consommateurs, la perception du risque associé à ces investissements, qui agissent comme des freins à la concrétisation de l'intention des consommateurs, ménages ou industriels. Il faut donc un effort collectif et de leadership à tous les niveaux pour surmonter ces barrières de différentes natures.

En introduction, **François Moisan,** modérateur de la session, rappelle les principaux messages et recommandations du rapport du Conseil Mondial de l'Énergie sur les politiques d'efficacité énergétique dans le monde.

L'enquête CME/ADEME, qui couvre plus de 85 pays dans le monde, montre qu'il y a de plus en plus de pays qui mettent en œuvre des politiques d'efficacité énergétique et que chacun des pays amplifie son bouquet de politiques. Ainsi ¾ des pays enquêtés ont une institution spécifique dédiée à la mise en œuvre de l'efficacité énergétique (agences d'efficacité énergétique par exemple). Plus de 80 % (contre 40 % en 2006) des pays ont des objectifs quantifiés d'efficacité énergétique. Parmi les politiques les plus répandues, les labels sont en plein essor et plus d'une dizaine de pays ont adopté plus de 10 labels d'efficacité énergétique. Un constat équivalent pourrait être établi sur les normes minimales d'efficacité énergétique. Une étude de cas sur les politiques favorisant la pénétration de systèmes d'air conditionné performants mentionnée dans le rapport montre que les labels et les normes d'efficacité permettent de faire émerger des équipements beaucoup plus performants que la moyenne des équipements installés (plus pour les labels que les normes).

D'un autre coté on constate au niveau mondial et pratiquement dans toutes les régions du monde un ralentissement des progrès de l'efficacité énergétique sur les dernières années. Ainsi, si la baisse de l'intensité énergétique primaire (consommation énergétique primaire par rapport au PIB) a été de l'ordre de 1,3 % par an de 1990 à 2011, on observe un ralentissement (0,6 % par an) depuis 2008. Les raisons de ce ralentissement sont multiples : la croissance plus rapide des pays émergents à forte intensité énergétique, la pénétration de l'électricité, le ralentissement économique dans la zone OCDE, etc.

Au niveau sectoriel, si les situations sont différentes selon les pays, on constate deux usages pour lesquels les consommations augmentent partout dans le monde : la consommation d'électricité dans le bâtiment et la consommation des transports :

- **La demande croissante d'électricité des ménages** est un des grands enjeux énergétiques sur lequel les efforts d'efficacité énergétique doivent être renforcés. En effet, on constate que dans pratiquement toutes les régions du monde, la consommation d'électricité par ménage électrifié augmente depuis 1990. Elle croit de plus en plus rapidement dans les pays en développement (qui se situent aux alentours de 1 500 kwh par ménage/an) et continue d'augmenter – même si moins rapidement – dans les pays de l'OCDE. Le Japon est l'exception notable, et dans une moindre mesure l'Europe, puisque les phénomènes de saturation du taux d'équipement des équipements électriques ainsi que l'impact des politiques publiques d'efficacité énergétique ont pu, ou vont, inverser la tendance récente.
- **Dans les transports**, la croissance démographique, l'augmentation du revenu des ménages et de la croissance économique poussent les consommations d'énergie vers le haut. Cette augmentation est en partie compensée par des gains technologiques. C'est ce que l'on constate dans un grand nombre de pays (y compris la Chine et l'Inde) où les consommations unitaires (l/100 km) ont baissé de façon significative depuis 2000. Cette tendance devrait se poursuivre partout sous l'impulsion de politiques publiques, en particulier les normes et labels, mais aussi la fiscalité.

Il faut donc consolider nos efforts en accélérant la mise en œuvre de politiques en tenant compte bien entendu des spécificités nationales. Parmi les recommandations du CME, François Moisan a particulièrement souligné les stratégies suivantes :

- **Les prix de l'énergie doivent être ajustés aux prix réels** afin de donner le bon signal aux consommateurs.
- Bien que cela ne soit pas toujours faisable, **les réglementations doivent être mise en œuvre et régulièrement renforcées,** et le contrôle de leur mise en œuvre accentué.
- **Les consommateurs doivent être informés** afin qu'ils prennent la bonne décision : la facturation intelligente de l'énergie par exemple délivre un potentiel d'économie d'énergie significatif.
- **Le comportement des consommateurs** doit être analysé et pris en compte, en particulier à cause de la croissance importante des TIC.
- **La garantie de qualité de produits et services efficaces** est un enjeu important auquel il faut apporter une réponse.

Maria van der Hoeven, directrice exécutive de l'AIE, délivre un message identique sur la nécessité d'accélérer les politiques d'efficacité énergétique. Son message tient en 5 points :

- L'étude récente de l'AIE sur les marchés de l'efficacité énergétique dans les pays de l'OCDE montre que l'efficacité énergétique a un marché de l'ordre de 300 milliards de dollars au niveau mondial, supérieur à celui du marché des centrales thermiques.
- En 2011, l'efficacité énergétique est devenue le premier « combustible » (au sens où l'efficacité énergétique se substitue à des énergies consommées).
- Il existe de bonnes pratiques de l'efficacité énergétique dans tous les pays. Les labels, les normes, les obligations des compagnies énergétiques peuvent être considérées comme des politiques efficaces. Mais celles-ci doivent s'inscrire dans un contexte de prix élevés de l'énergie. Ceci est particulièrement important pour le secteur des transports.
- Les gouvernements doivent prendre sérieusement les options offertes par les politiques d'efficacité énergétique dans les exercices de définition d'un mix énergétique souhaitable.

- L'efficacité énergétique est une option pourvoyeuse d'emplois. Au Royaume-Uni par exemple, le « Green deal » pourrait créer 75 000 emplois d'ici 2025 ; la commission Européenne estime à 800 000 emplois l'impact de la stratégie Énergie-Climat ; la politique de rénovation dans le bâtiment pourrait aussi créer 350 000 emplois en 2020 en Europe.

En conclusion, l'AIE considère que l'efficacité énergétique est un « Nexus » du trilemme du CME. Les politiques d'efficacité énergétique ont prouvé qu'elles pouvaient être efficaces dans tous les contextes nationaux.

B. Prasada Rao, président et directeur général de Bharat Heavy Electricals Ltd (Inde), développe l'idée selon laquelle l'efficacité énergétique doit être considérée comme une autre source d'énergie qui est abordable, mais sous-exploitée. Il cite le président américain Barack Obama qui lors de son discours sur l'État de l'Union en février 2013, a appelé à baisser la consommation d'énergie de moitié d'ici les 20 prochaines années. Il note que David Cameron, le Premier Ministre britannique, a déclaré dans le même mois que dans la course aux ressources limitées, le pays efficace en énergie sera le mieux placé pour gagner la course. **L'efficacité énergétique doit donc se réinventer aujourd'hui**.

Nous avons parcouru un long chemin, en partant d'une notion « d'austérité » axée sur « l'économie d'énergie » à « l'efficacité énergétique », axée sur la technologie et maintenant à la « productivité énergétique ». En 2009, J.Cullen et J. Allwood de l'Université de Cambridge ont considéré que sur les 475 Exajoules d'énergie primaire utilisée dans le monde, seulement 55 Exajoules de services énergétiques sont vraiment utilisés, soit 11 %. L'ACEEE en 2012 a démontré que le coût d'un kWh économisé grâce à l'amélioration de l'efficacité énergétique est inférieur d'un tiers ou moins du coût de toute nouvelle source d'approvisionnement en électricité, d'origine fossile ou renouvelable.
Le gouvernement indien a pris diverses mesures politiques et réglementaires d'efficacité énergétique. L'Inde a pu réduire son intensité énergétique et l'élasticité de la demande d'énergie au PIB, qui était de l'ordre de 0,73 entre 1981 et 2001 et a baissé à 0,66 sur la période de 2001 à 2011. Parmi les politiques d'efficacité énergétique qui ont prouvé leur efficacité, le schéma de répartition des obligations d'efficacité énergétique entre entreprises fortes consommatrices d'énergie, « **designated consumers** », est intéressant. Dans le domaine de l'éclairage, le programme de subventions différenciées selon les revenus des ménages pour la **substitution des lampes à incandescence par des lampes basse consommation** s'est avéré une réussite.

Plusieurs initiatives récentes en Inde telles que le « super programme d'efficacité énergétique », les réseaux intelligents, l'introduction de la technologie supercritique pour les centrales au charbon devraient non seulement permettre d'accélérer l'efficacité énergétique, mais aussi rendre le secteur de l'énergie économiquement et environnementalement soutenable. Les facteurs critiques de réussite seraient la mise en place de subventions ciblées sur les ménages pauvres, la participation des ESCOs dans les schémas de financement, comme le démontre le programme sur l'éclairage à Bungalore. **La réussite des programmes passe avant tout par la mobilisation du plus grand nombre de parties prenantes dans cet exercice qui repose toujours sur une combinaison d'approches.**

Tadj Oreszczyn, professeur de l'énergie et de l'environnement et directeur de l'Institut UCL énergie, University College London (Royaume-Uni), observe que la plupart des pays développés ont d'importants plans visant à réduire la demande d'énergie en améliorant l'efficacité énergétique et le comportement des consommateurs grâce aux nouvelles technologies et aux politiques publiques.
Cependant, ces technologies et politiques ne fonctionnent souvent pas comme prévu lorsque confrontées au monde réel, qui se compose d'un système socio-technique complexe.

Par exemple, de nombreux bâtiments utilisent deux fois plus d'énergie que ce que les normes de construction avaient supposé à leur conception.

Une approche pluridisciplinaire montre qu'il y a analogie entre la recherche sur la santé - qui utilise des études épidémiologiques pour évaluer les bénéfices des médicaments ou l'impact des politiques sur la santé de la population - et la recherche sur l'énergie. Afin que les pays puissent compter sur les résultats de leurs programmes d'efficacité énergétique, ils doivent comprendre l'impact de ces programmes d'efficacité énergétique sur la population, en développant par exemple des programmes d'épidémiologie de l'énergie, qui renseigneraient rapidement ceux qui conçoivent les nouvelles technologies sur l'impact des politiques ou des technologies. Le retour rapide est essentiel car de nombreux programmes peuvent durer des décennies, comme dans le logement. Le développement des nouvelles technologies de l'information permet d'entreprendre des études épidémiologiques de l'énergie à un coût minime.

La résolution des facteurs critiques de la bonne réalisation des programmes d'efficacité énergétique passe par l'information des consommateurs. La réglementation doit jouer un rôle important : elle doit être renforcée et sa mise en œuvre contrôlée.

Shugang Wen, président directeur général de Dongfang Electric Corporation (Chine), considère également que l'efficacité énergétique est une nouvelle source d'énergie. Il rappelle que l'approvisionnement énergétique doit être sécurisé. De son point de vue, il y a trois voies pour améliorer l'efficacité énergétique : la technologie, le changement de comportement des consommateurs et la mise en place de politiques.

Il confirme les résultats sur la baisse importante de l'intensité énergétique en Chine ainsi que le ralentissement récent mentionné dans l'étude CME/ADEME**. Le gouvernement chinois a pris de nombreuses mesures pour améliorer l'efficacité énergétique,** qui accompagne la restructuration économique du pays et la rénovation des équipements. Shuang Wen prend l'exemple qui concerne son entreprise de production d'équipements pour les centrales électriques. Il informe l'audience du développement important et très rapide des programmes d'efficacité énergétique au niveau de la production d'électricité en Chine, en particulier pour les centrales au charbon. La plupart des centrales à charbon doivent maintenant utiliser la technologie « supercritique » qui permet une augmentation très importante du rendement des centrales. **Pour dépasser les barrières à l'efficacité énergétique les gouvernements doivent déployer des subventions ciblées et le gouvernement doit établir un système de sanction.**

En conclusion, François Moisan rappelle que la bonne pratique de mise en œuvre des politiques d'efficacité énergétique repose sur l'élaboration d'un bouquet de mesures qui intègre en particulier la réglementation et les mesures d'incitation économique, soutenues par des programmes de formation et d'informations des consommateurs. Au-delà de ces principes généraux, chaque gouvernement doit définir son programme en tenant compte des circonstances nationales.

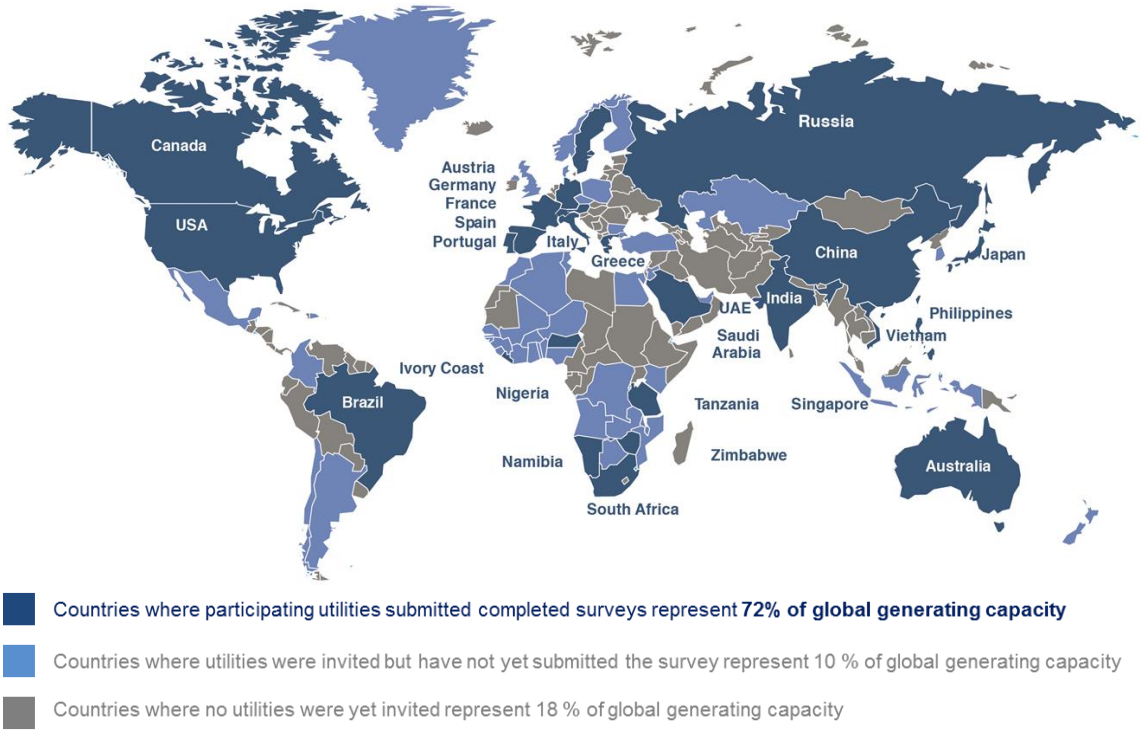
Philippe Joubert

Executive Chair, GEI (Global Electricity Initiative)

17 October 2013 - What is GEI

The Global Electricity Initiative (GEI) is a unique initiative by the World Energy Council (WEC), the World Business Council for Sustainable Development (WBCSD) and the Global Sustainable Electricity Partnership (GSEP), with the objectives to showcase voluntary action undertaken by the electricity industry around the world to increase access to affordable, reliable and environmentally sound electricity supply. The GEI activities include a global industry survey, development of the foundation for more efficient and sustainable company strategies and policies, establishment of a global benchmark for best practices and promotion of international cooperation between utilities around the world. This also includes support for the objectives of the UN Sustainable Energy for All project.

Figure 1: GEI industry survey coverage



Today, electric power utilities operated in an uncertain world with often changing and disruptive regulatory, environmental, supply and cost pressures. Utility CEOs often receive conflicting messages from the regulators, their customers and shareholder and other stakeholders. In addition, signals from the financial markets do not leave much space for making truly long-term, strategic business decisions.

Furthermore, there is an increased pressure on operational efficiency, including workforce productivity. Operational effectiveness of business is a function of human performance and the degree to which valuable "lessons learned" have been captured and institutionalised. While much of this knowledge is explicitly managed through policies, procedures, access to engineering data, etc., other knowledge is implicit or only informally documented, relying on person-to-person communication and unstructured dissemination.

The initiative relies on a highly effective decentralised organisational structure with an Industry Leaders Advisory Board which includes CEOs from the world's 15 major electric power utilities. The Board's main task is to provide the GEI with strategic guidance and industry insights. Philippe Joubert is the GEI's Executive Chair and the secretariat is run by the World Energy Council with support of the international project team. Deloitte South Africa are GEI project partners. The members of the Board are:

- Brian Dames (Chair), Eskom, South Africa
- Nick Akins, American Electric Power, USA
- Andrew Brandler, CLP Holding Group, Hong Kong, China
- José Antonio Vargas Lleras, Codensa, Colombia
- James E. Rogers, Duke Energy, USA
- Hervé Machenaud, EDF Group, France
- Ali Hassan Ibrahim, Egyptian Electricity Holding Company, Egypt
- José da Costa Carvalho Neto, Eletrobras, Brazil
- Thierry Vandal, Hydro-Québec, Canada
- Sam Amadi, Nigerian Electricity Regulatory Commission, Nigeria
- Arup Roy Choudhury, NTPC, India
- Evgeny Dod, RusHydro, Russia
- Peter Terium, RWE, Germany
- Saleh H. Alawaji, Saudi Electricity Co., Saudi Arabia
- Liu Zhenya, State Grid Corporation of China

GEI at the World Energy Congress

The initial insights into the innovative solutions and actions have been presented and discussed at the premier global energy event, the 22nd World Energy Congress, held in Daegu, Republic of Korea on 13-17 October 2013. The Congress has attracted over seven thousand participants from 120 countries, including CEOs of the leading global utilities, ministers and other top-level executives. The GEI initiative was highlighted in several key Congress sessions and thoroughly discussed at the private GEI Round Table which took place on 17 October. Over 50 high-level participants, including the majority of the GEI Industry Leaders Advisory Board members attended the Round Table, and a lively exchange of views confirmed that utilities and other major electricity sector players face similar challenges all over the world. The participants also agreed that GEI was a powerful alliance which could make things happen by leading the global dialogue between the industry and governments, sharing experiences and expertise, and showcasing best practices.

Chair of the UN Sustainable Energy 4ALL initiative and Special Advisor to the UN Secretary General, Kandeh Yumkella addressed the participants and provided insights into the progress of the UN activities in the energy access area and invited GEI to participate in the main UN meetings.

The challenges that utilities are facing in meeting the objectives of sustainable development, security of supply and affordability are immense and require rigorous examination and debate by all concerned. Today, the electricity industry in many countries is facing complex and often incompatible obligations that have been formulated by policy-makers in their best intentions. All of the commitments have almost equal importance and have been formulated to address the pressing issues, including universal access to electricity, climate change, environmental sustainability and affordability. However, it is in the implementation that major challenges for utilities are arising. Many of the regulations and market mechanisms that have been put in place around the world have created more uncertainty for utilities and placed the continued viability of some utilities at risk.

The important issues raised by the participants in the Round Table also included growing land and water requirements, different approaches to managing climate change, the roles of regulations, policies and stakeholders. Regional integration of energy systems was identified as a priority aspect of future development of the electricity sector.

Figure 2: Initial findings on mitigation

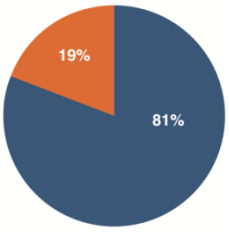
CO_2: 100% of the GEI utilities report that the price of CO_2 is crucial in defining their mix.

But: Current price level is too low to change the mix. Long term stability of the price and of the policies are a must

Too many UNCERTAINTIES prevent change!

Initial Findings and Future Steps

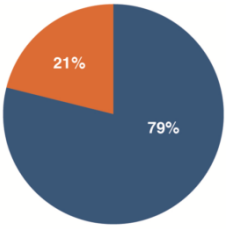
Technological advances have spurred the growth of renewable energy in power generation, improved energy efficiency and brought about an increase of connections to electricity in many parts of the world. Nevertheless, it is becoming increasingly evident that the journey towards a lower carbon society is still long, as according to the industry survey, fossil fuels are expected to remain dominant in the fuel mix of many utilities well into 2035. This has significant implications for efforts to reduce carbon emissions and achieve climate change targets. Another challenge is the integration of intermittent renewables into electricity systems. Therefore the majority of GEI utilities are developing the necessary processes. Overall, the utilities recognise that climate change is a reality and on the "route to resilience" they see mitigation measures as important as adaption.



81% of the GEI utilities report that they have energy efficiency programmes in place – due to regulation

Access to electricity also remains a major challenge in many countries, especially in Africa and Asia, and it is imperative to address this situation, taking into consideration the impact that the lack of electricity has on the quality of live, economic growth and development and the provision of primary social services such as health and education.

Most of the GEI utilities' customers are aware of climate change…
But 79% are NOT willing to pay higher electricity prices for low-carbon electricity.



All GEI utilities are increasingly focusing on stakeholder engagement to make their planning, projects and operations more predictable and transparent to address the needs of all stakeholders.

Looking ahead, GEI will focus on increasing the number of companies participating in the survey to reflect the collective views of the electricity industry. Some early findings require further examination. To complete the picture, face-to-face meetings and interviews with utility leaders will be conducted to solicit their visions of the electricity sector's future and agree common recommendations to policy makers. It is planned to complete the final report by mid-2014.

Pierre Gadonneix

WEC Chair

17 October 2013 - Congress closing ceremony

Excellences,
Ladies and Gentlemen

The 22nd World Energy Congress is coming to a close. It has been a remarkable four days and a remarkable success.
I would like to say thank you to those who made it possible.

- His Excellency Sang-jick Yoon, Minister of Trade, Industry and Energy for his important support of the Congress.
- Mayor KIM, Bum-il and the City of Daegu for their gracious welcome to the Congress delegates and for supporting the event.
- KEPCO CEO, Cho Hwan-eik, Chair of the 2013 Congress Organising Committee and the members of the Organising Committee, for their commitment to the success of the Congress.
- Jongho Lee, Secretary General of the Congress Organising Committee, and his team, for their constant efforts and many months of extremely hard work to organize the Congress.
- Dr Christoph Frei, WEC General Secretary, and the Congress programme team in London for organizing an outstanding Congress programme.
- And most of all… you, the delegates, who have come from around the world to engage in dialogue, debate and discussion about the most important energy issues facing the world today.

Ladies and Gentlemen,

I have been and still am sincerely honored to have chaired such an institution and such a dynamic organization for these last 6 years, and I want to extend to you my most sincere thanks for all the work we have accomplished together during my two mandates as WEC Chair. This tremendous amount of work has led us here, to Daegu, with an impressive program of keynote speeches, topical sessions, community roundtables, side events, and, above all, strong messages about energy to convey to the world.

Together, we have made WEC a richer organization, a stronger platform that is now well-equipped and ready to seize new responsibilities on the international scene.

From an operational point of view, WEC has made tremendous progress in becoming more visible and in making its research more broadly communicated and hence useful. Our website has been completely renewed; our ongoing dialogue with energy leaders has been enriched with regular regional events but also an ongoing series of WEC energy Leaders summits all around the world and a now constant desire to make its voice heard through an improved communication activity.
As you can measure, WEC has really progressed these last 6 years towards being a more effective and proactive player on the energy scene, actively supporting and advising energy leaders, advocating good practices and broadcasting better understanding of the future.

These are only few of the numerous great achievements that WEC has reached to in the last 6 years, of which I am particularly proud and for which I would like to thank you all.

Tonight, as I handover to WEC's new Chair, I want to conclude on thanking the whole WEC community for having given me so much not just during my terms as WEC chair but also for the 22 years I have been involved with WEC.
I also want to thank you for having provided me with opportunities to further engage with sectors I am passionate with and I wanted to contribute to, I mean: industrial sectors, international sectors, and sectors that need both hands of markets and public policies…

I was lucky to chair WEC at a time when the sector had to face a turning point, I was lucky to chair WEC and lead so many changes and initiatives. But, I was above all lucky to chair WEC with you, since none of these great achievements would have been possible without the involvement of all of you! Indeed, WEC would not be WEC without its 94 member committees and 3000 member organizations: let me thank them all for their longstanding commitment and hard work in all our study groups and programs, and events. Member committees are WEC's constant stimulus to improve our research, our communication and also our governance. It has always been a pleasure, during my years with WEC, to meet with WEC's members committees, and to learn from them the reality and diversity of the complex world of energy.

I thank all of you and wish you, wish WEC, a great continuation**.** I don't say "Good Bye" but **"**Thank you", "Merci", "Gamsa Ham-ni-da".
I see many challenges for WEC to reach in the future: starting with an improved role of WEC in international governance on the climate, on the rules of trade, on the safety of all energies, on energy access; but also with an improved contribution to shaping global world-reference energy scenarios, and advising government leaders for public-policies, etc. The journey ahead of WEC is thrilling and I wish you a lot of courage and enthusiasm in embracing these challenges. I have complete trust that WEC's new Chair Marie-José Nadeau will be the right driver and the insightful force to guide WEC in this new voyage.

I also want to assure you that my interest in and commitment with the world energy sector remains total, that my aspiration to resolve its critical issues is stronger than ever, and that I will definitely continue to contribute to it in the future!
And now, it is my great honour and privilege to introduce to you two very important people.

The first is Younghoon David Kim, who today takes on the role of WEC Co-Chair; this is new role within WEC and it is entirely appropriate that its first incumbent is Younghoon David Kim, who helped bring the 2013 Congress to his hometown of Daegu and under whose leadership the Congress has been such an outstanding success. Co-Chair Kim will serve in this role for three years and then will become WEC Chair at the 23rd Congress in Istanbul. Co-Chair Kim, please stand and be recognized as you take on this important role.

And now, I want to introduce my good and long-time friend and colleague, Marie-José Nadeau, who takes over from me as WEC Chair. Mrs Nadeau has been involved with WEC for many years, having served on the Finance Committee and as Chair of the Communications Committee. She knows WEC very well and I am confident that I am handing over the reins to someone who is eminently qualified to lead our organization forward with great dynamism and enthusiasm. I should also point out that this is the first time in WEC's 90-year history that a woman has been elected as Chair. We can be proud of this significant progressive and important milestone, and I cannot think of anyone better qualified to take on this role than Marie-José Nadeau.

Marie-José Nadeau

WEC Chair

17 October 2013 - Congress closing speech

Your Excellencies,
Ladies and Gentlemen,
Colleagues and dear friends,

As the World Energy Congress 2013 draws to close and my new role as Chair begins, I would like to start by echoing Pierre Gadonneix in thanking all those who played a part in making this event such a remarkable success: the Presidency and Government of Korea, the City of Daegu, the Korean Organising Committee, individual Member Committees, WEC London's Staff and all those who directly or indirectly were involved in the multiple teams organizing Daegu 2013.

In all, this Congress has involved almost 100 different sessions or events covering the entire energy spectrum.

That is truly remarkable!

As we get set to leave this wonderful country, allow me to say a few words of reflection about the Congress, what it says about the world of energy and what it means for each of us individually.

The first point is an obvious one: over the past four days no less than 50 ministers or their deputies, almost 100 CEOs, more than 100 high-level energy experts and over 6,000 delegates have participated in this Congress. This tells us not only that energy issues represent one of the greatest challenges facing mankind but also that the World Energy Council and its triennial Congress is the leading forum discussing them. Few - if any organization - are as inclusive and diverse as ours, be it in terms of its regional representation or the scope of its membership. Energy consumers, energy producers, governments from developing as well as emerging economies, multilateral agencies, environmental NGOs, private and public corporations, academics, all sit at the same table united by an understanding of the value of energy and the need to use it wisely with a view to the needs of future generations.

The second point is that close to 100 sessions discussing key issues on energy and the environment reflects the growing complexity of the world of energy. Our immediate challenge is to find a way of distilling the outcomes from all these sessions into a series of meaningful lessons or messages that we can take home to our respective stakeholders be they governments, energy companies or consumers.

For me, as Chair of World Energy Council, this is a challenging task. For start, we, as World Energy Council, have to ask ourselves how we can reconcile the different energy realities of our global constituents. Such questions are important because there is no single global energy agenda. We each have our own priorities.

Let me give you an example. Energy market competition and energy regulation are two key inter-related issues in developed economies. But what meaning do they have for a village in a developing country struggling to convince a state-owned power company to expand its grid by

an extra kilometer to bring electricity to the village for the first time? At World Energy Council we are equally engaged with both sides of the equation.

I firmly believe that the Energy Trilemma provides a simple and effective way to frame the debate: energy access, energy security and environmental mitigation are the three key pillars in which we can all discuss the most pressing problems facing energy and find consensus on appropriate solutions.

As this Congress comes to a close, it is appropriate reflect on some achievements and the next steps that we need to take before our next Congress in Istanbul in three years time. Let me focus on just two topics: the availability and the need for energy.

Session after session in this Congress has shown us that global energy supplies are plentiful. Continued exploration successes and emerging technologies have ensured that we have plentiful supplies of coal, oil and natural gas resources. Likewise, technological advances have made renewables more viable and nuclear safer. And hydro power remains a massive resource with huge untapped potential.

Yet, 1.2 billion people remain without access to energy.

This event was not a Ministerial Conference yet we brought together more than 50 ministers. It was not an Industry Convention yet we brought together more than 100 CEOs. It was not a Technical Meeting but we brought together several thousand experts. It was not a Financial Summit but we brought together dozens of financiers. Acting in concert, we – governments, corporations, technical experts and financiers – hold the key to a better future for these 1.2 billion people. For four days, we have worked for this and we need to take this further. As I assume the Chair of World Energy Council, I will ensure that we continue to use WEC's power of cohesion to catalyse change and translate the consensus into actions, the results of which will be reported in Istanbul in 2016.

It is with enormous pride – and some trepidation, I must say it - that I take up the baton as Chair of WEC. This is clearly a unique organization made up of Member Committees in 94 countries, representing over 3,000 organizations covering the entire energy spectrum.

And having mentioned 94 member committees let me extend a special welcome to two new members of our family: Bahrain and Iraq. Please give them a round of applause.

As Mr. Gadonneix just recalled, I started my involvement with WEC quite some time ago – 1998 was it. WEC as I know it today is a completely different organization for the one to which I was introduced 15 years ago. And I have watched first as member of the Canadian Member Committee and subsequently as Chair of Communications and Outreach Committee how WEC has transformed itself into a more active and more effective organization with a wider reach and considerably greater influence.

Today, it is an active participant in the global energy debate. Its reports are widely read and quoted and the World Energy Council not only has consultative status at the UN but plays an active role in its key initiative, the UNSE4ALL program.

WEC is, in effect, the United Nations of energy spanning all energy forms and all corners of the globe. Like all representative organizations there are always areas in which we need to grow and to become stronger.

Earlier, I stated that few, if any, global energy organizations are as inclusive and diverse as the World Energy Council. That might be true but it does not mean we cannot improve both: our inclusiveness and our diversity.

On Monday, it was my pleasure to meet some of WEC's Future Energy Leaders. WEC's Future Energy Leaders Program, as we just found out, brings together 100 young energy professionals for a series of exclusive events alongside the Congress. This year's cohort, of whom a third are young women, comes from 45 countries, including 20 developing nations. Meeting these young professionals, I was struck by their enthusiasm and their firm belief in the positive benefit of energy. These young people represent our future. They are WEC's future.

Over the next three years, I will work to strengthen our Future Energy Leaders program and seek to widen the WEC community. We still have countries that are not represented at all and we have under-representation of key stakeholders in both our membership and governance structure. As a membership organization we all need to work on this together.

This evening I would like to pay tribute to Pierre Gadonneix, who for over the past six years as Chair and over 22 years as being involved in our various committees and congresses. Pierre has worked closely with the Executive Assembly and secretariat to move WEC into the top league of global energy organizations. Even though his term has come to an end, I know that we can count on his continued friendship and support.

As many of you know, at the WEC Executive Assembly held on Sunday, WEC member committees have agreed to appoint Pierre Gadonneix as honorary chair – the first honorary chair ever in WEC's history. Your contribution to WEC has been exceptional and you have had a distinct influence on what WEC has become. Thank you very much on behalf of all of us.

Ladies and Gentlemen:

World Energy Congress 2013 has been an unqualified success. Once again, I thank our Korean hosts who have worked so hard, I will say night and day, to make this happen and who have made us feel so welcome. I look forward to meeting you all again in Istanbul in 2016.

Thank you very much.

Congress News

- Securing our future
- Al-Falih hails ‘crown jewels’ of the global energy mix
- Urgent need for global nuclear power standards
- Asia ponders impact of shale gas boom
- Natural gas the ideal fuel for world’s urban future
- Energy leaders give stark warning on climate change
- Energy Ministers: active government policy, investment key to solving "Energy Trilemma"
- Governments and industry should cooperate to solve energy trilemma
- South Korean President Park calls for broader Asian energy cooperation
- Interview of the new WEC Chair, Marie-José Nadeau

Securing our future

Prime Minister of Korea, Jung Hong-won

14th October - As delegates arrive in Daegu, Damon Evans weighs up the issues topping the agenda at the World Energy Congress 2013.

More than 5,000 delegates from more than 100 countries are gathering in Daegu, South Korea's green growth capital, to discuss the critical issues facing the industry under the theme "Securing Tomorrow's Energy Today" at the 22nd World Energy Congress (WEC) this week.

WEC Daegu 2013 marks only the second time in the event's 90 years that it will be held in East Asia, part of the world's most dynamic energy market.

Led by China and India, along with Southeast Asia, the centre of gravity of the global energy system is fast shifting to Asia.

Energy consumption is expanding more quickly in the Asia-Pacific region than in any other part of the world, as its economies surge forward.

However, Asia's prolonged economic boom has depended on cheap oil prices. But when crude surged in 2008, approaching $150 per barrel, the region felt at first hand just how vulnerable it was to oil price shocks.

Since then, the nuclear power crisis in Japan, as well as increasingly volatile oil markets, have combined to lend a greater urgency to the need to ensure energy security. Not just in Asia, but across the globe. At the same time, the impending threat of climate change needs urgent attention.

As demand for energy snowballs, the important issues for Asia, as well as the rest of the world, are: how can we conserve energy and use it more efficiently? Can renewable energy become the world's green gold? And will efforts to mitigate climate change affect access to future energy sources?

Many Asian countries have integrated the concept of sustainable energy – otherwise known as green energy - into their national visions. And delegates will have the opportunity to hear what is going on in the region, which holds half of the world's population and shows signs of rapid green energy growth.

But despite proposed energy efficiency initiatives, many of which will be discussed, global energy demand is still projected to double by 2050. The world's energy leaders face an enormous challenge to meet this demand.

This week those leaders together with delegates will voice their ideas and seek solutions to the challenges facing the industry. Will shale gas and oil provide the answer or will it be the untapped potential of hydro? Where do the new frontiers fit in?

Aside from shale gas and tight oil, shale oil has big potential. There are also opportunities for methane hydrates, deep-water fields, heavy oil and Arctic exploration, to consider.

But not forgetting the world must cut its addiction to fossil fuels, which are largely responsible for climate change. Emissions of carbon dioxide (CO_2) must be slashed by 50% in order to stop global temperatures rising to risky levels.

Transportation, one of the world's fastest expanding energy-demand segments, driven by China and India, is a big culprit. It makes up 23% of global CO_2 emissions, almost half of which come from cars.

At the Congress, delegates will hear about the prospects for the transition to a low-carbon economy. Alternative fuels, electrification of transport and fuel efficiency are some of the areas that could cut the carbon footprint.

Meanwhile, attendees will also discuss whether today's markets and technologies can deliver tomorrow's energy. Indeed, the globalisation of energy demand poses a number of challenges, coined the "energy trilemma" by the World Energy Council, the sponsor of the Congress.

This week policy makers and industry leaders will be seeking solutions that will allow them to balance energy security, environmental, as well as social objectives. But in order to maintain and replace existing energy systems, as well as meet growing energy demand and climate objectives, significant investment is needed. To the tune of around $45 trillion - or half the world's gross domestic product - over the next 20 years. The market alone cannot solve these problems. All this and a lot more will be discussed at WEC Daegu 2013.

Prime Minister Jung calls on energy community to meet challenge

Thousands of delegates greeted the opening of the 22th World Energy Congress at the Exco centre in Daegu. The congress was declared open by Hwan-Eik Cho, chairman of the WEC 2013 organising committee, who said his heart was pounding to speak before so many of the world's energy experts, *writes Conal Urquhart*.

Jung Hong-won, the prime minister of South Korea, also spoke at the opening. He said: "Energy is a daunting challenge and must be addressed by the international community. Energy must be safe, accessible and environmentally friendly. The most important thing is international co-operation."

In a statement to mark the opening of the congress, the WEC warned that several prevailing myths are severely hampering the efforts of governments, industry and civil society to create a sustainable energy future. Pierre Gadonneix, chairman of the World Energy Council, said events such as recession and the Fukushima disaster had transformed the energy sector since the last congress in Montreal in 2010.

"It is vital that we form a coherent, long-term framework within which to plan and implement future investment. Leadership is needed if we are to address the triple challenge of the energy trilemma, affordability, accessibility and environmentally sustainable energy for all", he said.

Al-Falih hails 'crown jewels' of the global energy mix

14th October - Aramco chief's calls for greater energy efficiency echoed by GE's Bolze

The head of Saudi Aramco, the world's largest oil company, hailed the world's abundant fossil fuel resources in his keynote speech, the first of the World Energy Congress 2013.

Khalid Al-Falih, chief executive of Saudi Aramco, said the world's reserves stood at 14 trillion barrels of oil and 7,000 trillion cubic feet of gas, or, at present rates of use, about 50 years supply of oil and 250 years supply of gas. Al-Falih told delegates: "The earth is blessed with a colossal endowment of fossil energy. Current proven reserves of 1.6 trillion barrels, which equate to half a century of global oil production at current rates, are at their highest level ever. Oil and gas are the most efficient, convenient, economic and reliable energy sources the world has ever known."

He called fossil fuels "the crown jewels" of the world's energy mix, but insisted they should be used efficiently; leveraging them by combining their use with that of nuclear, hydro and renewable energy. Al-Falih also used his keynote to stress Saudi Arabia's focus on the development of solar power: "In Saudi Arabia, our vision is to turn it into a global solar power hub, and we are investing heavily in the research, development and utilisation of solar energy." But he said the world cannot afford to continue to subsidise renewable energy, adding the market was the best mechanism to decide the appropriate mix between renewable and fossil fuels.

Al-Falih's address was followed by a speech by Steve Bolze, chief executive of GE Power and Water who outlined four technical developments which will have a major effect on delivering "tomorrow's energy today", the key theme of WEC 2013.

Bolze said: "Those areas are the rise of brilliant machines, the proliferation of gas networks, the decentralisation of power and the coming of age of mainstream renewables.
"I often get asked: How do I get more productivity out of my existing assets and how do I eliminate unplanned downtime. Brilliant machines are opening up opportunities to achieve these goals. They are enabled by the industrial internet, a convergence of digital, industrial and analytical worlds which is taking place right now. It will transform the energy landscape."

Bolze said that the analysis of industrial data can prevent stoppage and maximise performance. "We can make average plants on average days the best plans on best days", he said.

He said natural gas will replace oil and coal as the primary fuel for consumption by around 2030, adding that the large – and small-scale networks required to transport gas from supplier to user will make energy use more efficient and accessible. He described power decentralisation or

distributive power as "mechanical or electrical power at or near the point of use" as an important method of providing energy to emerging markets.

Bolze said that he expected renewables to increase their share of the global energy mix from 5% to 10% in the next years, aided by innovation and improvement in efficiency. "When we got into the wind business 10 years ago wind was producing electricity at 15 cents per kilowatt hour; it is now 5c per kwh. I believe the world will double its wind and solar from 5% to 10% in the next 10 years. Germany is already at 25%. We continue (the drive towards a future with) subsidy-free wind power", he said.

He added that criticism of solar and wind powers on grounds of intermittence were being undermined by new technology. "Industrial internet and energy storage are now chipping away at the intermittency challenge", Bolze said.

Exclusive interview: "We need new thinking for the new realities we face"

Saudi Aramco's chief executive Khalid Al-Falih tells WEC *Congress News* that the energy industry must work together to find solutions to the challenges that lie ahead.

What is Saudi Aramco's strategy in adapting to the new global energy landscape as the global energy resource base increases and amid forecasts that the US may achieve energy independence within the next decade?

Saudi Aramco views these developments as opportunities for us to grow our business as well, thanks to the technological advances that have made possible the growth of unconventional resources and explore new frontier areas. Indeed, Saudi Aramco has embarked on a transformational journey to become a world leading integrated energy and petrochemicals enterprise.

We have demonstrated for decades in continuing investments for the long term in energy infrastructure - upstream, downstream, technology, addressing imbalances between crude oil mix and refining capabilities - we have done and continue to do that. Saudi Aramco is committed to ensuring stability and security in global energy markets.

Enhanced energy security is good news for producers and consumers and we welcome developments about the growth in the oil and gas resource base not only in the US but around the world where countries, which are primarily consumers, have the opportunity to grow their economies because of new found access to energy resources.

While the landscape has changed, Saudi Aramco's annual capital program has scaled up. These additional resources would help in providing much needed feedstock to our downstream-refining-petrochemicals ambitions to become a leading player worldwide within the decade.

What do you perceive as the main challenge facing the world's energy industry in the medium term?

The global energy landscape has been transformed profoundly in the three years since the last World Energy Congress in Montreal. Today, the industry is healthier, more dynamic, and within three short years, we have witnessed momentous change with breakthrough technological innovations seeing the industry move away from the misconceptions of peak oil towards an era of abundance. Despite this, all of us in the energy industry face a historic challenge.

Today, about one-third of the world's 7 billion people consume more than two-thirds of its primary energy supplies. The other 5 billion people have varying degrees of access to energy supplies, with some trapped in extreme energy poverty.
By 2050, a total of 9 billion people will aspire to a better and prosperous life. We need to acknowledge, and recognise, that ready access to clean energy will be a right for all. That is the challenge the world faces and the test we must pass as an industry.

How will the increase in the world population affect the outcome for energy demand or consumption scenarios?

With the global population projected to grow by 2 billion, the global economy could be three or hopefully even four times its current size by 2050. More people, more affluence, greater mobility, more urbanisation – that means demand for more goods and services. This will drive demand - for fuels, electricity, chemical feedstocks, and that ultimately means more energy is required. Assuming that the entire global population in 2050 will consume energy at the same level of prosperous nations today, global energy demand could rise from some 260 million barrels of oil equivalent per day (boe/d) to roughly 860 million boe/d. That's more than three times current consumption.

However it is not preordained that demand has to rise to those levels, even if everyone has access to enough energy. Improved energy intensity is our lowest hanging fruit and can deliver similar economic growth using considerably less energy.
By setting aggressive targets on efficiency and demand management, we could dramatically reduce energy consumption while enabling access to energy by more people, saving trillions of dollars, and improving environmental performance.
Improving efficiency in both energy conversion and widespread end-use applications is challenging, but I am pleased that many nations have already taken bold steps in that direction.
In Saudi Arabia, the government has launched major initiatives to significantly improve energy efficiency in power generation, and is encouraging more efficient energy use by industries and transportation, and in buildings.
But even assuming the world does lower its future energy intensity to an optimal level, future demand will be substantially higher than it is today.

So with the anticipated increase in consumption, how can the industry ensure that supply keeps up with demand?

The industry has moved from a period of misconception about peak oil to an era of abundance. We have already produced about 1.3 trillion barrels, yet proven reserves have never come down. Indeed, current proven reserves of 1.6 trillion barrels, which equate to a half-century of global oil production at current rates, are at their highest level ever. And these numbers will continue to rise with increased exploration and higher recovery.

At Saudi Aramco, thanks to innovation, we are on track to increase the average convention oil recovery rate to 70%, which is more than double the current world average.
More broadly, looking at the earth's total endowment of liquid fuels, there are about 14 trillion barrels of original resources in place, divided about equally between conventional and unconventional resources.
Human talent and ingenuity are critical to manage this massive endowment and current proven reserves have a lot of room to grow, and such reserves will be necessary to sustain rising oil demand in the long term.

Similarly, current proven gas reserves of more than 7,000 trillion cubic feet (cf) have enormous room to grow, considering that the unconventional gas revolution has expanded the world's

technically recoverable gas resources to the range of 30,000 trillion cf. If we could economically recover them, they can meet global gas demand at current rates for more than 250 years!

What are the prospects for unconventional resource development in Saudi Arabia?

The shale revolution won't be limited to the US and I believe it will become a global phenomenon as many other areas of the world hold enormous potential for unconventional resources. The rush is definitely on!

In Saudi Arabia, two years since launching our unconventional gas programme in the frontier Northern Region, we are ready to commit gas for the development of a 1,000 megawatt power plant, which will feed a massive phosphate mining and manufacturing centre and drive that region's development and the prosperity of its people.
This is just one of the latest examples of oil and gas powering prosperity around the globe.

Where do you see oil and gas in the global energy mix in the next few decades?

I can't emphasise enough that oil and gas are the most efficient, convenient, economic and reliable energy sources the world has ever known. And they will undoubtedly continue to be the crown jewels of world energy supplies well into the future.
But we shouldn't stand still. We should further improve their environmental performance. And we should extend their use by appropriately combining them with other sources like nuclear, hydro, coal, and renewables which play an increasingly important, complementary role.

I would also add that these sources of energy are needed to meet global demand in the long term – we recognise that Saudi Arabia, for example, is embarking on plans to turn the kingdom into a global solar hub, and has invested heavily in the research, development, and utilisation of solar energy.

How can the industry position itself to meet the supply challenge to be able to provide access to clean energy for 9 billion people?

We need all hands on deck. The industry needs to work together. I will outline the prerequisites, which I believe are essential for the industry to meet this challenge in the long term. There is a clear need for progressive, pragmatic and plausible global energy policies.
Since all energy sources will be required, we shouldn't prematurely pick winners and losers; selectively subsidise; set unworkable targets; or apply unrealistic regulatory and fiscal regimes.
Instead, we should allow technologies to mature to offer confidence in large-scale deployment and, let me stress that markets need to be allowed to work.
Policies need to be more rigorous and holistic, and I believe the World Energy Council can play a significant role here.
Then adequate, timely, and long-term investments must be made in all energy sources to ensure sufficient supplies are safely and reliably delivered to news customers.

In just the next two decades, total energy investment is forecast to be in the range of $40 trillion. These investment levels are staggering, and to fund them continuously, projects will need to be profitable and bankable. For that to happen, we need more certainty in the future direction of world energy markets, relatively healthy prices, and pragmatic policies. Market stability is critical, and here Saudi Aramco continues to play a pivotal role.

Collaboration across the board among stakeholders is another prerequisite - that is required to connect the dots along the value chain to create a viable future for the entire industry.

Can you elaborate on Saudi Aramco's role in the global petroleum markets in relation to recent supply disruptions?

In the past two years alone, we have swung our production by more than 1.5 million barrels a day (b/d) in order to meet market supply imbalances. And we continue to make massive investments to maintain the world's largest spare oil production capacity of more than 2 million b/d. But that's only one aspect of our broader investment across the value chain. As part of our drive to become the world's most integrated energy company, we have increased our annual capital expenditure programme from $4 billion to $40 billion over the last few years. That's in addition to scaling up our investment in talent, research and development (R&D) and technology, which is one of the prerequisites for success.

Given industry developments over the last few years, how has that affected your R&D and technology strategy?

Our R&D and technology strategy has evolved because of the greater opportunities available in the marketplace today. One of Saudi Aramco's strategic goals is to become one of the world's leading creators of energy technologies by 2020. Funding for in-house R&D has increased significantly while we have formed and continue to form world-class strategic alliances as part of our open network innovation strategy.
Soon, we will have eight satellite research centres operating across the world while our venture capital subsidiary (Saudi Aramco Energy Ventures) has begun investing in pioneering technology companies.

What are the main challenges for Saudi Aramco in the next decade and how are you planning to prepare the company?

The philosophy underpinning Saudi Aramco's corporate transformation is a focus on leveraging our strengths and comparative advantages to exploit the full potential of our company. The challenging agenda we have set for ourselves fundamentally involves moving from being a traditional oil and gas supplier to a fully integrated and competitive global energy and chemical enterprise; and in the process, be a catalyst for the kingdom of Saudi Arabia's economic growth. The transformation encompasses a wide range of initiatives for our various businesses and operations and also requires new thinking for the new realities we are being confronted with.

Urgent need for global nuclear power standards

15th October

When the Fukushima nuclear accident occurred more than two years ago, it was initially predicted that it would bring to an end the nuclear renaissance that was expected to help meet the world's growing power needs. But reports about the decline of nuclear power appear to have been greatly exaggerated.

It is becoming increasingly clear that nuclear power will continue to play a central role in solving what the World Energy Council calls the "Energy Trilemma," the ability of the world to ensure the security of energy supplies and provide energy access for the poorest people, while making sure that the environment is protected from harmful emissions.

As was revealed in the World Energy Council's report "One year after Fukushima", published in 2012, more than 50 countries, half of them newcomers, are currently operating, building or considering nuclear power as a viable option for electricity generation, with at least 60 nuclear power plants now being built in China, India, Russia, Korea, France, Finland and the UAE. In contrast, only a few countries, including Japan and Germany, initially decided in principle to abandon nuclear power in the wake of the Fukushima accident.

The future of nuclear energy can be secured as long as the safety and transparency of the nuclear industry is continuously reinforced. Public acceptance of nuclear power will be achieved if an efficient system of governance for nuclear safety is put in place that is internationally credible.

The Fukushima accident should be turned into an opportunity to reinforce the necessary international coordination on matters of nuclear safety. International governance on nuclear safety has already improved since the Three Mile Island and Chernobyl nuclear accidents in 1980s. But more still needs to be done when it comes to the conception and design of nuclear plants; their operation, crisis management and dismantling; and the communications, transparency and control by independent authorities.

Reinforcing international coordination on nuclear safety is an ambitious goal considering the need to respect legitimate concerns with regard to national sovereignty. But we believe progress can be made.

Currently, nuclear governance largely lies with nation states, with a limited level of oversight by the International Atomic Energy Agency and peer reviewed by the World Association of Nuclear Operators and the Institute of Nuclear Power Operations. These institutions provide the necessary foundation to advise and increase international coordination and cooperation on all aspects of nuclear safety.

An expression of consensus on the issue by representative international political bodies could help legitimatize the move towards improved global governance of nuclear power.

Such measures would not only regain public trust in nuclear power but also increase the capacity of nation states to participate in international governance. International accord is hard to achieve on any topic, but the safety of global nuclear power is one of the rare issues on which international agreement can be achieved with a reasonable level of effort given its importance.

We realize this will be a gradual process. A survey of the 93 national committee members of the World Energy Council found that in terms of implementing safety and regulation, most WEC members showed strong political support for the adoption and convergence of international safety regulations, but this was not matched by support for the international enforcement of safety standards.

However, most member countries strongly agreed that there is a need to improve public understanding and acceptance of nuclear technology and its costs and risks.

We believe the process should begin with the development of minimum and harmonized international nuclear safety objectives, in coordination with the IAEA and national safety agencies. National adherence to these standards shall also be verified by a legitimate institution.

Examples of successful global governance can be found in many industries and may provide models for the nuclear power industry. The aviation industry, for example, has many similarities with the nuclear industry since both have competing designers, manufacturers and operators, all of whom work under national authorities. Yet, the aviation industry uses international certification standards to ensure airworthiness as well as protocols for navigation systems and other aspects of operation. Aircraft safety is no longer a factor in the competition between manufacturers: competition works on other criteria.

Alongside these activities focused on nuclear safety, there should be parallel attempts to increase global governance of other energy sources. For example, offshore oil exploration can pose serious problems to the environment as recent big oil spills proved. This question is going to become more crucial as the world attempts to conduct offshore drilling in the Arctic.

A good starting point in achieving these goals is the discussions among government ministers and industry leaders here in Daegu. We believe that WEC can be a catalyst in the world's attempt to build dialogue, share vision and develop global governance for nuclear power and other energy sources to achieve a sustainable future.

Pierre Gadonneix
WEC Chair

Hwan-Eik Cho
President and Chief Executive of Korea Eletric Power Corporation and Chair of the Organizing Committee of the World Energy Congress

Asia ponders impact of shale gas boom

15th October - By Younghoon David Kim, Co-Chair Elect, World Energy Council and Chairman of the Daesung Group

The hot topic within the South Korean energy industry is North America's emergence as the centre of the new global energy revolution. The shale gas boom in the U.S and Canada could lead to the continent's energy independence in the next 20 years, which would have a profound impact on reshaping the global energy map. Korea and the rest of Asia are looking closely at how energy developments in North America will affect the region's energy mix. So it is not surprising that energy was a central issue during the state visit of Korean President Park Geun-hye to Washington earlier this year, particularly since Korea is the world's second largest importer of liquefied natural gas (LNG).
The U.S Department of Energy recently approved four permits for facilities being set up to export LNG to countries with which the U.S. does not have a free trade agreement, offering the hope that the U.S. will become a major supplier of LNG to its Korean, Japanese and Taiwanese allies, which together constitute the single largest LNG market in the world. The U.S Department of Energy has already approved the daily export of 1.4 billion cubic feet of natural gas for the next 20 years. According to the U.S Energy Information Administration, U.S. natural gas production will continue to increase at a rate of one percent per year through 2040, exceeding domestic demand and encouraging further exports. The U.S. natural gas industry could contribute nearly $332 billion to America's gross domestic product by 2035, according to IHS Cera, the U.S. energy research firm.

Whether Asia's hopes of benefiting from the North America's shale gas can be fulfilled remains to be seen. Infrastructure needs to be expanded on both sides of the Pacific to handle the export and import of more plentiful LNG supplies that are being freed up by the shale gas boom. Asian LNG customers are also wondering whether the increased availability of LNG supplies will lead to a more flexible – and cheaper – pricing structure that would be delinked from oil prices. The numbers support an optimistic view. Beyond the U.S., estimates have increased about the size of natural gas reserves in the rest of the world, leading credence that we are witnessing a profound shift in the global energy map. Argentina is sitting on a estimated 21.9 trillion cubic feet (TCF), Mexico could have as much as 19 TCF, and early estimates suggest that China may have massive reserves of 36 TCF. Possessing smaller but more established reserves, many European countries are expected to be the next in line behind the U.S. in making shale gas commercially viable if some markets, such as France and Poland, can overcome regulatory hurdles, community opposition and high production costs.

This year's Congress is a major forum for Asian leaders to discuss the future of natural gas and other energy resources. The Asian and Pacific Energy Forum, a United Nations-organised gathering of regional government ministers in Vladivostok, Russia, noted that the Congress "will provide a platform for all stakeholders in the energy sector to meet and exchange views on regional and global energy issues." The Congress could play a significant role in outlining the path ahead for Asia's energy mix.

Natural gas the ideal fuel for world's urban future

16th October - **Helen Robertson, Daegu**

"Natural gas can be the urban fuel of the future. It can help to tackle the pollution crisis in some of the Asian cities. By replacing coal fired power, it sharply reduces the emissions of pollutants", said Shell's chief executive, Peter Voser, to delegates at WEC 2013.

"Gas power stations are also the most practical option in urban areas. They emit few pollutants and there is no need for lengthy transmission lines to carry the electricity."

Gas demand in the Asia Pacific region was 625 billion cubic metres (cm) last year, according to Cedigaz. The International Energy Agency (IEA) expects demand in Southeast Asia alone to soar by 80%, to 250 billion cm per year, by 2035. The region's population is expected to increase by a quarter over the next 20 years, the agency said.

"It's clear that Asia's economies have entered a historic phase of industrialisation and urbanisation" Voser said. "The Chinese economy is changing at 10 times the speed of Britain's during the Industrial Revolution - and at 100 times the pace." Voser added: "The pace of change is almost inconceivable. Millions of people are emerging from poverty. This is not only transforming Asia's energy system but also the world."

Voser said there are three main steps Asia must take to cater for the growing energy needs of its rapidly-expanding population, most of whom will live in urban areas. Cities are expected to account for more than 75% of total energy consumption within the next 30 years.

Asia must implement "intelligent urban planning", Voser said, to cope with soaring energy demand. This includes planning for the use of natural gas as a transport fuel, as well as encouraging people to use public transport and to make shorter journeys by car.

The region must also diversify its energy supply mix and instigate policies to encourage the investment Asia will need in new sources of energy. "Intelligent urban planning could transform the entire global transport system. It would provide the infrastructure for a cleaner car fleet powered mainly by electricity, hydrogen and natural gas. Natural gas is the urban fuel of the future" Voser said.

China is already developing liquefied natural gas as a transport fuel, particularly in the trucking and shipping industries. Other countries, such as the US, are also using gas as a transport fuel in long-haul trucking. Voser said replacing oil products with natural gas in transport fuels could significantly cut carbon emissions and slash oil-import bills, particularly for countries such as China. By 2020, China is expected to spend $500 billion per year on crude oil imports, according to research carried out by consultants Wood Mackenzie. In September this year, China overtook the US as the world's largest net crude oil importer. Local air pollution is a huge problem particularly in Asian cities. China has taken steps to curb its air pollution by pledging to cut its coal use.

Voser said that natural gas could provide a solution to tackle the issue of chronic urban pollution. Natural gas emits around half the amount of carbon dioxide that coal does when it burns. To increase the use of cleaner-burning fuels, such as natural gas, in global transport networks, co-operation would be needed from multiple cities worldwide and governments, Voser said. He added governments must create the right regulatory and fiscal framework to encourage the investment needed in infrastructure and in developing new sources of energy.

Energy leaders give stark warning on climate change

16th October - Climate change experts have warned that the international community must do more to halt global warming, *writes Helen Robertson*. Yvo De Boer, a climate change and sustainability advisor at KPMG, said that since the Copenhagen talks in 2009, climate change has been "off the international politic agenda" and this has put the world at great risk of catastrophic environmental change.

The next international climate change talks are due to take place in Paris in 2015. International negotiators will aim to commit all nations to agree to take action on climate change. "I would concentrate (the talks) on a limited set of issues that first get the international political process moving again, define commitments with what is currently economically realistic and create a pathway to enhance action over time", De Boer told delegates attending the energy and climate scenarios panel session on Monday. However, he added that legally binding climate change targets must be avoided "because they are impossible to implement". De Boer said political leaders may be forced to deal with "short-term pain, long-term gain" in terms of the costs of implementing carbon reduction schemes. Political leaders must also form agreements to help developing countries deal with the effects of climate change, he said.

Brian Dames, chief executive of South African utility Eskom, said as Africa's electricity demand rises mitigating the effects of climate change are more important than ever on water-poor continents. "We have to monitor very carefully changes in technology and society and who is connected to the grid", Dames said. "Water availability is the biggest issue for Africa in terms of climate change. Re-use of water becomes crucially important."

Ged Davies, chief executive of the Forescene SA consultancy, said we are unlikely to keep global temperature rises to within 2 degrees Celsius – the level climate scientists say would be a crucial tipping point in bringing about irreversible and damaging climate change. "The starting point has to be the development of climate science", Davies said. He added that the industry must communicate better the effects of climate to the public to help push it to the top of political agendas worldwide. Developing effective carbon markets would also help provide an incentive for nations to tackle climate change, he said. "The disappointments in Europe's (emissions trading scheme) haven't helped others", he said.

The International Energy Agency (IEA) has warned that we are not on track to limit a global temperature rise to within 2 degrees. Last year energy-related carbon dioxide emissions increased by 1.4% to a record high of 31.6 gigatonnes, the IEA said. The IEA said if we continue to emit such high levels of carbon dioxide (CO_2) emissions, global temperatures are more likely to rise by between 3.6 and 5.3 degrees Celsius. This could have disastrous environmental, social and economic costs. The IEA said there are four main ways we can cut carbon emissions including limiting the use of inefficient coal plants and improving energy efficiency. Halving methane emissions from the upstream oil and gas industry and cutting fossil fuel subsidies could cut global CO_2 emissions by as much as 30%, the agency said.

Energy Ministers: active government policy, investment key to solving "Energy Trilemma"

16th October - Energy ministers from China, Russia, and Canada said on Wednesday that proactive government policies and robust investment are key pillars in ensuring a steady supply of energy amid soaring global demand, while dealing with the "energy trilemma" of security, sustainability and access.

"China's energy development challenges are dire," said Wang Yumin, Vice Administrator of China's National Energy Administration. "There are new challenges because new sources of demand are being created." Wang said consumption is growing 5.8% annually in China when China needs to sustain 10% economic growth per year in order to realize the "Chinese dream" of stable development. Wang said China had managed to provide rural heating to 70% of the rural population, and has used advanced turbines and other technology to disadvantaged groups. He pointed out that China's energy efficiency is approaching 90%, but that the government would need to implement "strict measures" to keep energy consumption under control. "People's lifestyles will have to change," Wang said.

Russian Energy Minister Alexander Novak said "It is clear that the main component of the trilemma is energy security—unless it is guaranteed, all other good intentions fade into insignificance." He said Russia will continue to raise the issue of global energy security at international forums such as APEC and G20 summits. Novak said Russia will also propose ways of establishing a transnational energy infrastructure to service areas with energy production deficits. "This is of special relevance for the APR [Asia Pacific region]," Novak said, "as high economic growth rates and population increase bring about greater energy consumption." Novak pointed out Russia is increasing the capacity of its Northern Sea Route to provide shorter and more productive routes for energy supplies.

Canadian Minister of Natural Resources Joe Oliver told delegates Canada is undergoing a series of economic reforms to streamline and cut red tape on major energy projects. "Expanding and diversifying our energy exports is a top priority of the Canadian government," said Oliver. "Canada has an emerging LNG industry and a strategic imperative to become an important supplier of energy to Asia." The Minister also highlighted that about $650 billion in new investment is planned or underway over the coming decade in hundreds of major resource projects in Canada.

Government and industry should cooperate to solve energy trilemma

16th October - With growing energy demand in Asia and coming challenges in the global market, industry and governments need to work together to find solutions to tackle the "energy trilemma" of energy equity, energy security, and environmental sustainability, said panelists at the opening session of the World Energy Congress on Wednesday.

"There is a lot of common ground between industry and government," said Jon Drzik, CEO of Oliver Wyman, the international management consulting firm. "Solving the energy trilemma requires a sustainable policy that endures over time, requiring a partnership between industry and government." Experts suggested how to approach the energy trilemma, and where the main challenges will come from in the coming decades. "Energy efficiency is at the heart of any solution for Europe and for our energy trilemma," said Maria Van der Hoeven, Executive Director of the International Energy Agency (IEA).

Experts said that integration could help tackle the energy trilemma, bringing about greater energy security and efficiency. "If you want to change your energy mix, you have to be mindful of the consequences of the region," Van der Hoeven said, offering the example of Germany. "You can't do things alone."

Luis Enrique Berrizbeitia, the Executive Vice Presidnet of the Development Bank of Latin America (CAF), similarly suggested an integrated outlook, drawing on the experience of Latin America. "There are plenty of opportunities to satisfy security needs, especially if we advance on the integration front," he said. "Integration can bring combined resources of region in an efficient manner."

He pointed out that the region already has a clean energy matrix drawing on hydropower, with the growing participation of wind and solar, and the region is endowed with resources. Different regions and nations will face unique challenges in the coming years that will all contribute to the global picture. "Energy access, energy security, climate change are all very important objectives. The size of this triangle is shaped in a different way from region to region and country to country," said Riccardo Puliti, Managing Director for Energy and Natural Resources sectors at the European Bank for Reconstruction and Development.

"To find a solution, there are global targets, but there are also regional and national targets that contribute to this global target," he said.

South Korean President Park calls for broader Asian energy cooperation

16th October - South Korea's president voices support for proposed gas trunkline from Russia.

Governments around the world, and especially Asia, need more international cooperation to address the problems of energy security, providing access to energy for all and mitigating climate change, South Korea president Park Geun-hye told delegates at WEC 2013.

"To overcome the energy trilemma the world faces right now, we need a transition in global energy cooperation to bring down the walls between energy producing and consuming countries", said Park. "Especially in Asia, which has a mix of countries with strong energy demands and countries with huge energy supply potentials."

To that end, Park backed long-discussed proposals that would see Russia develop its vast East Siberian gas reserves and build export capacity to the Chinese, Japanese and the South Korean markets. "In the 1980s, Russian gas was developed and introduced to Europe. We need to have new initiatives for energy cooperation like this" Park said. "We need to create the conditions where the joint cooperation could be made for oil and gas development in East Siberia and also shale gas development in China and North America."

Russia has been discussing the development of East Siberian gas for export with China for nearly a decade, though disagreements over price have been the main sticking point in those discussions. In addition to sending gas to China, Russian gas export monopoly Gazprom has proposed either building a pipeline through North Korea or a subsea gas pipeline from China's northeast coast into South Korea if a deal cannot be reached with Pyongyang.

Park also urged the region's governments to work towards better integrating their energy infrastructure. "We have to create the environment that makes energy infrastructure connected

with each other, including regional power grid, gas pipe network, and oil pipelines," she said. This cooperation could be promoted by legal frameworks, such as a Energy Charter Treaty, which would encourage investments from both the private and public sector.

The region's governments should work on a new cross-border energy agreement that would establish the legal and political framework needed to attract private investment for the projects, said Park.

Park also called on governments and international institutions to shift their focus from fossil fuels to clean energy. “Currently, energy policies and institutions in most countries have focused on stable supply of fossil fuels. We have to review from scratch whether the existing energy policies and institutions are appropriate to achieve our new goals of securing clean, safe and available energy for all”, she said.

Park pledged that South Korea would use its experience of rapid economic and energy development over the past 50 years to help lead the way on addressing the world’s pressing energy problems. “Korea will play a leading role in resolving the energy trilemma facing the world,” she added, based on her domestic policy of promoting a “creative economy.”
Park pointed to the use of advanced technologies in the power distribution network as a way Korea plans to improve its energy efficiency, create new jobs and build new markets. "We will reduce the electricity consumption by using ICT, including Energy Storage Systems and Energy Management System and build a system where the saved electricity can be traded on the power exchange," Park said. "We expect that we can reduce up to 1 million kilowatts of peak electricity and create a 3.5 trillion won ($3.27 billion) market and 15,000 jobs through this system.”
“We will develop the energy industry into a driving force of the creative economy and share with the international community our know-how and experience in the transition to the creative energy economy,” Ms. Park said.
Although South Korea is one of the world's largest energy importers, Park said that the country still has much to contribute to the global energy market. Although the country is scaling back its nuclear ambitions at home after post-Fukushima safety concerns, South Korea is keen to export its knowhow abroad. The country won a $20 billion deal to build a reactor in the United Arab Emirates in 2009 and is keen to secure more such deals.

South Korea will also use its status as both major oil importer and oil products exporter to build cooperation in the international energy community, Park said. “We are now faced with the biggest challenge ever in relation to energy on a global scale," Park said. "Where there is a will there is a way. We are faced with challenges in the global energy sector but if we gather our wills together there must be a way and a solution.”

South Korea president Park Geun-hye and WEC Chair Pierre Gadonneix © WEC

Interview of the new WEC Chair, Marie-José Nadeau

What are your key takeaways from the 2013 Congress?

The Congress has been outstanding in terms of its programme and attendance. This is truly remarkable – and we owe it to WEC's London team and to the Korean Organising Committee. I think that the word – the buzzword of the Congress – is 'trilemma'. I firmly believe that our trilemma study provides a simple and effective way to frame the debate. Energy access, energy security and environmental mitigation are the three key pillars in which we can discuss the most pressing problems facing energy and find consensus on appropriate solutions. I hope that we can bring this initiative one step further in Istanbul.

What are your key tasks on the path to Istanbul 2016?

As always, we will work closely with the Organising Committee. We are fortunate that the Turkish Energy Minister was in Daegu, meeting with influential CEOs and other ministers. Istanbul, we must remember, is a bridge between Asia, Europe and the Middle East and we must take advantage of that extraordinary context. Once the Congress theme is agreed upon, we will be promoting the Congress with the view to attract as much attention and as many delegates as possible.

Give us an idea of your strategy and your vision for the next three years as Chair of the World Energy Council.

As Chair of the World Energy Council, three objectives will drive my action until our 2016 Congress. Like all representative organisations, there are always areas in which we need to grow and become stronger.

My first objective is to increase the WEC's presence in countries that are not represented or where we have under-representation of key stakeholders in both our membership and governance structure. I know I can count on the support of the co-chair and regional vice chairs to achieve this goal.

My second objective is to work on our inclusiveness and diversity. Few, if any, global organisations are as inclusive and diverse as WEC, both in terms of regional representation and scope of our membership. That does not imply that we cannot improve. I would like to see more young professionals, men and women, involved in the dialogue that we will be building. Securing tomorrow's energy today calls for the contribution of tomorrow's energy leaders. They have a word to say in the global energy debate. I will work with WEC's Future Energy Leaders with a view to have them participate actively in our discussions. I consider Turkey the perfect venue to give visibility to the upcoming energy leaders. And I insist on men and also women – currently there are very few women in the organisation. I am committed to be supportive of their endeavours to increase their participation in our various forums.

My third objective is to pursue our quest for excellence in our work programme, including our flagship reports World Energy Trilemma and World Energy Scenarios. These reports are widely read and quoted and they have contributed to move WEC into the top league of global energy organisations. It is my responsibility as Chair to ensure that our publications continue to meet the highest standards of governance and quality. To that end, I know I can count on all those involved in our work program, including our Member Committees and the Officers Council.

Le Conseil Mondial de l'Énergie

Fondé en 1923, le Conseil Mondial de l'Énergie (World Energy Council, WEC) est la principale organisation multi-énergétique mondiale. Organisation à but non-lucratif et non gouvernementale, agréée par l'Organisation des Nations Unies, le Conseil Mondial de l'Énergie est doté d'un statut de bienfaisance au Royaume-Uni et est partenaire stratégique d'autres organisations clés dans le domaine de l'énergie. Il est constitué de comités nationaux, représentant près de 100 pays dans le monde et composé de dirigeants du secteur énergétique. Il est régi démocratiquement par une Assemblée Exécutive, composée de représentants de tous les comités membres. Son siège est à Londres, il comprend parmi son personnel des coordinateurs régionaux qui exercent leurs activités en Asie, en Europe centrale et orientale, en Afrique et en Amérique latine/Caraïbes. Il est financé essentiellement par les cotisations des comités nationaux.

Le Conseil Mondial de l'Énergie couvre une gamme complète de questions liées à l'énergie. Il s'intéresse à toutes les énergies (le charbon, le pétrole, le gaz naturel, l'énergie nucléaire, l'hydraulique et les nouvelles énergies renouvelables). Il réalise des projections à moyen terme et long terme et travaille sur un grand nombre de thèmes liés à l'énergie (efficacité énergétique, environnement et énergie, financement des systèmes énergétiques, prix de l'énergie et subventions, pauvreté et énergie, éthique, normes, nouvelles technologies,...). Le Conseil Mondial de l'Énergie réalise des analyses, des recherches, des études de cas et des orientations stratégiques publiées sous forme de rapport et utilisées par les principaux décideurs. Des cycles de travail de trois ans aboutissent au Congrès Mondial de l'Énergie, événement majeur de l'industrie énergétique attirant plus de 5 000 délégués, incluant un programme technique, des réunions, des séances de travail en réseau et une importante exposition sur l'énergie.

Plus d'informations sur **www.worldenergy.org** et **@WECouncil (twitter)**

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Le Conseil Français de l'Énergie

Fondé en 1923, le Conseil Français de l'Énergie (CFE) est le comité national français du Conseil Mondial de l'Énergie. Ce dernier rassemble plus de 3 000 organisations et représente une centaine de pays dont les deux tiers de pays en développement. Il représente ses membres dans toutes les activités internationales du Conseil Mondial de l'Énergie.

Le Conseil Français de l'Énergie est une association qui a pour objectif de promouvoir la fourniture et l'utilisation durables de l'énergie pour le plus grand bien de tous. Le Conseil Français de l'Énergie regroupe des acteurs français (entreprises, administrations, organisations professionnelles ou universités) impliqués dans des réflexions qui privilégient les dimensions d'accessibilité, de disponibilité et d'acceptabilité de l'énergie dans une perspective mondiale ; toutes les ressources et les technologies de l'énergie sont représentées.
Le Conseil Français de l'Énergie soutient les recherches en économie de l'énergie et participe aux débats énergétiques, notamment par l'intermédiaire de publications et de conférences.

Le Conseil Français de l'Énergie assure la diffusion des résultats des recherches qu'il a financées. De plus, le français étant l'une des deux langues officielles du Conseil Mondial de l'Énergie, le Conseil Français de l'Énergie contribue à la promotion de la francophonie en traduisant en français et en diffusant les travaux les plus importants du Conseil Mondial de l'Énergie.

Plus d'informations sur **www.wec-france.org** et **@CFE_WEC_France (twitter)**

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