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World Energy Trilemma

Time to get real – the agenda for change

Project Partner OLIVER WYMAN

WORLD ENERGY COUNCIL

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“We can’t use the old paradigms if we really want to make changes.”

Introduction

Through 2012 and 2013, the World Energy Council (WEC) in partnership with the global management consulting firm Oliver Wyman, interviewed over 100 global energy leaders – chief executive officers (CEOs), senior executives, ministers for energy and the environment, senior policymakers, and regulators, as well as high-level representatives from inter-governmental organisations. The goal was to identify the necessary policies and regulation, industry actions, and barriers to the development of secure, affordable, and environmentally sustainable energy systems. Together, the interviewees represent an extraordinary body of energy industry knowledge, expertise and insights on what works and what does not work in terms of policy design and implementation.

The insights came from public and private decision makers from 41 different countries, and included: 46 ministers, policymakers and regulators representing 26 governments that legislate a combined 2.51 billion people; 45 executives representing 44 companies based in 22 different countries, accounting for over US\$2 trillion of annual revenue; 12 representatives from nine inter-governmental organisations; and seven representatives from six more international forums.

The research found many areas of broad agreement among public and private energy leaders on how to tackle the energy trilemma – the triple challenge of finding solutions that simultaneously support the three key aspects of energy security, energy equity, and environmental sustainability. This report, World Energy Trilemma: Time to get real – the agenda for change, sets out 10 areas for focused action identified in interviews and validated at a high-level dialogue in July 2013, in Paris (France). The challenge now lies in moving forward with all the necessary stakeholders, including the energy industry, consumers, citizens, the financial sector, policymakers, and regulators to put the agenda into action.

The world's energy challenges are well known: responding to a predicted growth in primary energy demand of between 27% and 61% through to 2050¹; meeting the needs of the 1.2 billion people currently without access to electricity and the 2.8 billion people who do not have clean cooking facilities²; investing in the update of ageing energy infrastructure; while reducing the environmental impacts of energy production and use. The pressing need to transform the energy system comes at a time when many governments are struggling with a significant debt burden and the lingering effects of the global recession. Maintaining a balance between the three legs of the energy trilemma can seem impossible.

At the same time, there are huge opportunities ahead in the energy industry: recent shale gas discoveries have impacted on the dynamics of supply; technological and cost breakthroughs have accelerated the adoption of renewables; electricity generation from renewable sources is predicted to represent 25% of gross power generation by 2018³; new technologies are increasing energy efficiency in transportation, buildings and appliances and decreasing the environmental impact of energy production and use; and the post-2015 millennium development goals constitute a renewed global focus on global energy access. We would seem to be at the point of a truly secure and sustainable energy future – if we can enact the required leadership.

The 2012 and 2013 World Energy Trilemma reports and this Agenda for Change provide a strong call to action by leaders and peers in the energy community. The time to act is now: it is time to get real. This report sets out 10 agreed areas for energy leaders to focus policies and resources on, to capture the opportunities and meet the needs of citizens and consumers. The public and private sectors must collaborate to design and implement broadly supported mechanisms to drive this change. Is this collaboration possible? Are we at a tipping point to making real breakthroughs in meeting the energy trilemma?

The energy trilemma

Creating a policy framework that simultaneously delivers secure, affordable, and environmentally sustainable energy – a sustainable energy system – is one of the most important challenges facing governments today. This triple challenge is known as the 'energy trilemma' (see Figure 1).

Each of the three legs of the trilemma is vital to the economic and social development of a country. Perspectives on urgency of the three pillars of energy sustainability vary across countries. While all countries are very focused on energy security, as it is critical to fuelling economic growth, there is more variability when it comes to energy access and affordability – the energy equity pillar – and even more so for the environmental sustainability pillar.

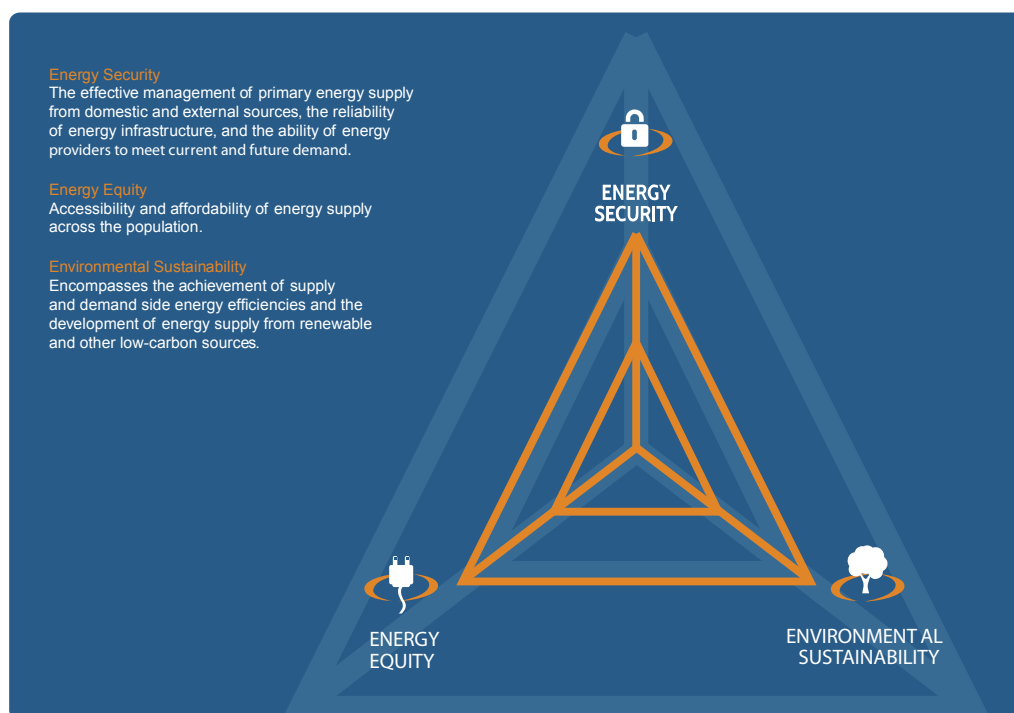
¹ WEC, 2013: World Energy Scenarios: Composing energy futures to 2050; The lower number refers to WEC's 'Symphony' scenario, which focuses on achieving environmental sustainability through internationally coordinated policies and practices, while the higher number reflects WEC's 'Jazz' scenario, which focuses on energy equity with priority given to achieving individual access and affordability of energy through economic growth.

² Sustainable Energy for All, 2013: Global Tracking Framework

³ International Energy Agency (IEA), 2013: Medium-Term Renewable Energy Market Report

The WEC's Energy Sustainability Index comparatively ranks countries in terms of their ability to provide a secure, affordable, and environmentally-sustainable energy system, and points to areas where action must be taken.⁴

Figure 1
The World Energy Trilemma



Driving sustainable energy development – three interconnected policy areas

Energy is fundamental to human society, social development and economic growth. It is critical to the development of a modern economy – for agriculture, transport, computing, manufacturing, construction, education or health and other social services. However, an 'energy gap' remains, with many people lacking access to energy and a deficit between current energy use and what is sustainable in terms of energy security, affordability or environmental impact.

The 2012 and 2013 World Energy Trilemma reports explored the causes of these energy gaps and the challenges in meeting the energy trilemma. In the 2012 report, World Energy Trilemma: Time to get real – the case for sustainable energy policy, over 40 energy industry CEOs and senior executives from across the sector and around the world set out the necessary policy frameworks to support the development of sustainable energy systems and to unlock much-needed investment. While, in the 2013 report, World Energy Trilemma: Time to get real – the case for sustainable energy investment, more than 40 energy and environmental ministers, policymakers and government officials identified what they want the energy industry to do. Furthermore, high-level representatives from multilateral development banks and

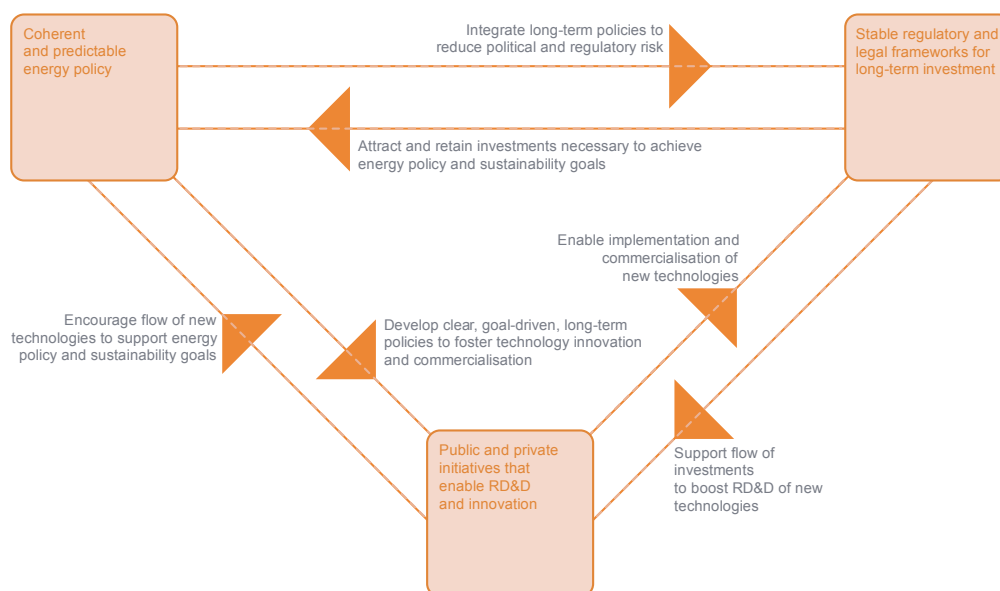
⁴ Results and analysis of the WEC's Energy Sustainability Index can be found in World Energy Trilemma: Time to get real – the case for sustainable energy investment, its companion report, 2013 Energy Sustainability Index and online at www.worldenergy.org/data/sustainability-index

inter-governmental organisations provided input and indicated where governments and the energy industry need to take action to tackle the energy trilemma.

Figure 2

Three key interconnected policy areas are necessary to support the transition to sustainable energy

Source: WEC, 2012: World Energy Trilemma: Time to get real – the case for sustainable energy policy



The 2012 and 2013 reports validated the three essential policy elements for the development of sustainable energy systems (see Figure 2).

Predictable and durable energy policies that go beyond the political cycle and have clearly defined goals are the cornerstones of a sustainable energy system. To support the formulation of policies, the energy industry needs to be proactive in sharing knowledge and taking a strong role in change management with regards to energy use. Policymakers must ensure that energy policies are: integrated with adjacent policy areas (for example, environment, industry, and transportation); include the promotion and support of energy efficiency; and are generally supported by citizens.

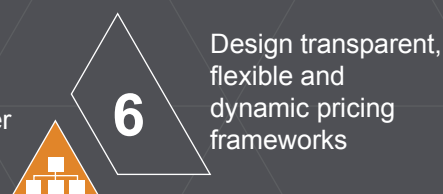
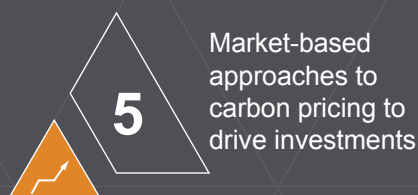
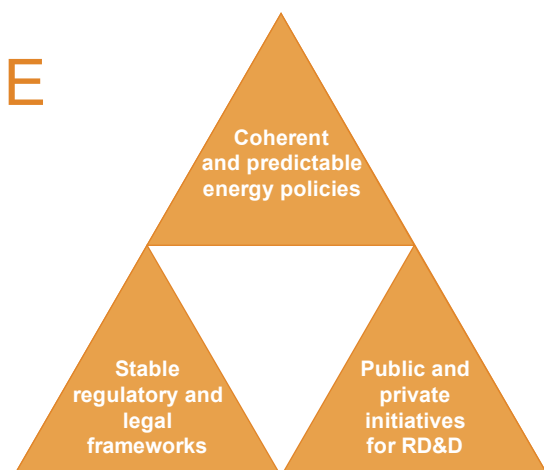
Against this policy backdrop, there is a need to implement consistent, predictable regulatory and legal frameworks to support long-term investment in energy infrastructure. These include the effective use of market-based economic instruments to level the playing field for all energy technologies. Alongside this, there is a role for carefully selected mechanisms to correct market failures such as, 'green' or infrastructure banks, green bonds, well-designed public-private partnerships, and carefully applied subsidies where necessary.

Lastly, public and private initiatives that enable innovation as well as research, development and demonstration (RD&D) projects are necessary to transform the way energy is produced and used. Industry must lead the way in bringing forward technological innovations.

Within these three broad framework areas, the interviews identified 10 action areas as mechanisms to achieve real breakthroughs in resolving the energy trilemma (see **Figure 3 – The agenda for change** on the right hand side).

10-POINT AGENDA FOR CHANGE

The World Energy Council's World Energy Trilemma 2012–2013 research programme captured the insights of more than 100 global energy leaders and led to the identification of a 10-point agenda to address three broad policy areas highlighted here.



The 10-point agenda for change

Define coherent and predictable energy policies

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

Energy challenges and goals must be embedded within the broader context of country competitiveness, economic growth, jobs and quality of life agenda.

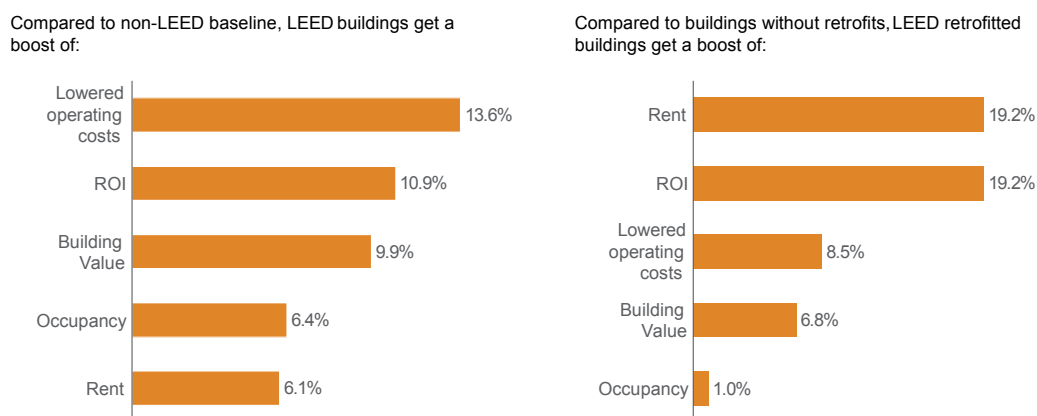
The energy trilemma discussion has to be more inclusive than narrow debates within energy ministries and the energy sector. It must be connected to the broader national agenda. The resolution of the energy trilemma is not solely a set of trade-offs and choices related to scarcity of resources, but an opportunity for innovation with far-reaching benefits. By embedding energy challenges in the wider context of competitiveness, economic growth, jobs and quality of life, the focus shifts to the opportunities and innovations at the heart of energy goals. The dialogue must also include other industrial sectors and energy system users who rely on an effective energy sector for economic growth and productivity.

In addition to reduced energy costs, markets reward those who develop and implement efficient technology. For example, improving energy efficiency in residential and commercial buildings, using the Leadership in Energy and Environmental Design (LEED) standards, slows the rate of energy demand growth, provides health benefits through improved housing, and drives an overall increase in asset value.

Figure 4

Rewards for developing and implementing energy-efficient technology

Source: McGraw Hill Construction's Green Outlook, 2011: Green Trends Driving Growth



To create an integrated and coherent energy policy framework, energy goals must support and align with the aims of critical adjacent policy areas – such as social development, industrial, financial, environmental, transportation, and agricultural goals – which all affect the achievement of energy policies. A portfolio approach that goes across sectors, including building stock, transport, and approaches to financing, ensures that policies do not contradict each other. For example, ensuring that trade policies do not limit the import of solar panels while supporting an energy goal to increase the use of renewables.

Box 1: Increasing energy-efficient consumer solutions through international standards

Policymakers noted that there should be an increased focus on opportunities to develop technology solutions that enable greater consumer energy efficiency. They are calling on the energy industry to collaborate with the relevant sectors of the manufacturing industry. To achieve this, policymakers and energy industry personnel noted the value of international standards which can help push the development and adoption of new technologies and innovations. Standards on regulations, light bulbs, and light and heavy duty vehicles were some examples; others included joint directives on ‘standby’ applications in household appliances such as refrigerators, televisions, home computers and other electronics. These efforts could achieve measurable impacts on energy efficiency in many countries, but this requires the collaboration of all stakeholders, including policymakers, regulators, manufacturers and the energy industry.

Action 2: Provide leadership to build consensus – nationally and globally

A broad consensus on energy strategy and goals is the core platform on which to craft predictable and durable energy policies.

Public and private energy leaders agree that a broad consensus – nationally and globally – on energy strategy and goals is the core platform on which to craft predictable and durable energy policies. Addressing the trilemma of energy sustainability presents extraordinary environmental, social and economic challenges requiring national and international action – not only by governments, but also the private sector and civil society. Reaching such an energy consensus requires honest communication and debate that involves all stakeholders: energy producers, consumers, the media, activist groups and non-profits/non-governmental organisations, and all levels of government (see Table 1).

Table 1
Energy system stakeholders

Source: Oliver Wyman, 2009: Keeping the Lights on Sustainably

Category	Group	Governance role
Suppliers	Energy companies and utilities, resource countries, transit countries	Policy implementation and system operation
Users	Domestic consumers, service business consumers, industry	Policy preference and endorsement
Enablers	National governments, national and international regulatory bodies, financial institutions, solutions providers	Policy direction, guidelines and boundary conditions; opportunity capture
Experts	University research departments, private sector firms	Solutions deployment
Commentators	Political parties, non-governmental organisations, media, research bodies	Policy analysis and endorsement

Letting the consumer make informed choices needs to be part of the solution.

However, policymakers and those in the energy industry appear to disagree on who should take the lead role in stimulating and supporting such a dialogue. Policymakers suggest that it is in the energy industry's self-interest to support a robust dialogue with the public. Specifically, the energy industry was called on to take a greater role in supporting the change management and communication necessary for the transition to sustainable energy. However, business points to government's role in obtaining the 'social licence', or the broad approval from the general public, and to take on the critical role in disseminating information, raising awareness, and stimulating broad stakeholder engagement.

The gap between policymakers and industry is reflected in energy debates. In many countries, discussions about energy policies rapidly become divisive due to a number of concerns, including cost, environmental issues, economic opportunities, and energy security. Politics, lobbying, 'short-termism' and other factors can have a negative impact on the dialogue and governments, and the energy industry can suffer a lack of trust from citizens and consumers. In summary, there are many factors – political, informational, procedural, and structural factors – that can lead to sub-optimal decision-making and policy implementation.

The energy dialogue has to be opened to additional stakeholders.

In many countries, there are issues of distrust in industry and government. Setting the national energy dialogue in the broader context can help increase transparency and encourage trust from consumers and citizens. The media, academia and scientists must all have a strengthened role in the energy dialogue with the general public. Energy companies should also continue to take steps to increase their engagement with consumers by using social media to increase the transparency and immediacy of their communications.

Action 3: Improve policymaker and industry dialogue

The alignment between forums, participants and their agendas needs critical evaluation to strengthen the energy debate and make it more effective.

All energy leaders believed there was need for more effective feedback and dialogue between policymakers and the energy industry. Currently, knowledge gaps can build distrust between key players. In particular, energy leaders acknowledge that the private sector should play a more active role in providing guidance, stakeholder impact assessments and technical expertise. This would enable better policy and regulations, and would also offset information asymmetries regarding the unique and rapidly evolving dynamics of each energy sector.

There are many existing forums for facilitating the exchange of information, knowledge and experience. However, the correct alignment between forums, participants and their agendas needs critical analysis and evaluation. Some forums may not effectively support highly technical discussions, and others geared to high-level discussions on the national energy strategy may not effectively bring in general public participants or

other key industrial sectors. For example, the current global climate change negotiations have limited opportunities for industry to contribute to the dialogue. The importance of effective input from all stakeholders, including the private sector, is increasingly recognised. For example, the United Nations (UN) post-2015 agenda clearly acknowledges that businesses will be essential to meeting the next series of global development goals.

Defining the right kind of engagement processes is critical to make public–private dialogue successful. Analytical tools and scenarios to structure the discussions must lie at the core of the process. Examples might include:

- Tools that enable leaders to assess the different energy pathways or what the different targets look like ‘in the real world’, as opposed to an abstract conversation about the economic impact of a 2°C increase in global temperature.
- Robust analytical tools and models supporting a data-driven discussion around how many power stations to build, or how many homes need to be retrofitted for different types of energy savings.

Such structured discussions allow industry personnel to share clear information on technology developments or the realistic timeframe needed to achieve these goals. Tools and scenarios would also allow energy leaders to engage economic ministries, industrial sectors and political leaders within a robust analytical and intellectual framework.

Establish stable regulatory and legal frameworks for long-term investment

Action 4: Increase engagement with the financial community

There is a significant amount of work to be done to enable the financial sector to make informed decisions.

Government officials, policymakers and energy industry representatives pointed to a group of stakeholders critical to enabling the transformation to sustainable energy systems: the financial sector. Cumulative investment of US\$37 trillion is needed in the world’s energy supply system over the next 25 years.⁵ Ultimately, to encourage investments, energy projects must have an attractive risk-return profile to meet the competition for capital. Energy leaders called for greater engagement with the financial sector to ensure potential investors have the necessary knowledge of the opportunities and risk management mechanisms to support necessary investments in the energy sector.

Currently, it is estimated that only 1% of OECD pension assets are directly invested in infrastructure (broadly defined).⁶ The barriers to, and potential solutions for, attracting more infrastructure investment, including energy infrastructure, from the private sector and institutional investors are the subject of a number of research efforts by leading organisations. For example, the OECD has held a number of roundtable discussions

⁵ IEA, 2012: World Energy Outlook 2012

⁶ Della Croce, R, 2012: Trends in Large Pension Fund Investment in Infrastructure, OECD Working Papers on Finance, Insurance and Private Pensions, No.29; Antolin, P, 2008: Ageing and the Payout Phase of Pensions, Annuities and Financial Markets, OECD Working Papers on Finance, Insurance and Private Pensions, No.29

on mobilising private investment in low-carbon, climate-resilient infrastructure. Most recently, the G20 finance ministers and the OECD held a high-level roundtable on institutional investors and long-term investment with some of the world's largest institutional investors.⁷ These discussions have identified the policy barriers to greater institutional investor participation (see World Energy Trilemma: Time to get real – the case for sustainable energy investment) and have also highlighted that many potential investors may have limited experience with energy infrastructure.

Of particular concern is the required expertise and market knowledge to evaluate the wide-ranging risks within energy infrastructure projects, including risks involving construction and politics or regulations. Currently, many energy sector projects are evaluated on the basis of their sovereign risk rating. The result is that some investments are deterred because of this limited or poorly applied standard approach to evaluating projects, even when – for instance – the power sector economics are positive. In other instances, the calculation of discounted cash flow analysis often does not include non-traditional risks, such as the risk related to investment in carbon-intensive technologies which may become stranded assets once appropriate pricing and policy frameworks for carbon emissions are in place. Factoring these risks into the analysis can shift the risk-reward profile for many renewable or low-carbon energy projects.

In addition, the financial sector may need to develop a more sophisticated knowledge of, and approaches to, the energy sector and how to apply risk mitigation tools used by the energy industry to support project development. For example, the availability of:

- Loan guarantees, power purchase agreements, and political risk insurance for the energy industry to mitigate political or regulatory risk.
- Green or infrastructure investment banks and development banks that can review viable projects to increase private sector confidence and investment.

Policymakers and the energy industry can take steps to facilitate institutional investors' participation in the sector. Potential solutions include:

- Increased collaboration among pension funds to share capabilities, especially expertise in analysing investments in emerging markets.
- Development of a system to standardise and classify a diverse set of long-term investments.
- Support for smaller investors to share information with larger groups in other sectors to help them analyse potential investment outcomes.
- Finding ways to help large international investors work with local partners and the energy sector when investing in illiquid long-term assets. Local partners can provide project-specific knowledge and insights, and collaboration can help them develop expertise for long-term domestic investment.

⁷ Several initiatives have been undertaken recently at the G20 and European level. In November 2012, G20 finance ministers and Central Bank governors requested that the World Bank, International Monetary Fund, OECD, Federation of Small Businesses, UN and relevant international organisations undertake diagnostic work to assess factors affecting long-term investment financing, including its availability. Separately, the European Commission launched a green paper in March 2013 on the financing of long-term investment, with the objective of increasing the supply of capital for such investment. Both initiatives focus on the ability of the financial system (including institutional investors) to channel funds towards projects and businesses with long-term planning horizons.

Box 2: Pension fund investment in infrastructure: lessons from Canada and Australia⁸

Investment in infrastructure has grown in popularity in recent decades and pension funds in Australia and Canada are world leaders when it comes to investing in this alternative asset class. These countries use two different, but equally successful models.

Australia

Funds in Australia have benefited from a recent trend towards the privatisation of public infrastructure assets. Today, it is estimated that Australia's pension funds invest an average of 5–6% of their assets in all infrastructure classes – up from 2% just 10 years ago. The pension system in Australia (and the government rules that regulate it) is set up so as to encourage longer-term investments, even though asset classes like infrastructure sometimes have less liquidity. Pension funds have managed infrastructure investment risk through two mechanisms. First, Australian pension funds primarily invest in infrastructure through specialised managed funds in order to diversify their risk. Second, by privatising and opening up mostly existing, 'brownfield' infrastructure assets to private investment, the Australian government has freed up public resources to tackle the riskier 'greenfield' projects.

Canada

In Canada, where there is resistance to the privatisation of public infrastructure, there is a supply-side shortage of domestic projects to invest in, forcing Canadian pension funds interested in this asset class to develop equity stakes in airports, wind farms, and natural gas processing plants abroad. The Canadian pension system is, by design, rather concentrated, meaning that funds have the scale and resources to take on these often larger, potentially riskier foreign projects. Unlike their Australian peers, Canada's pension funds use a model of direct investment and have developed large, specialised, in-house expert teams to not only manage the investments but also exert control over the assets themselves. While direct investment is easier for larger funds, Canada's smaller pension funds and institutional investors have pooled their resources together through organisations like the Infrastructure Coalition Program, allowing them to directly invest in infrastructure as well. Canada's pension funds see allocation rates and returns that are similar to those in Australia, proving that there are multiple, equally sustainable models for stimulating investment in infrastructure from pension funds.

⁸ Inderst G, Della Croce, R, 2013: Pension Fund Investment in Infrastructure: A comparison between Australia and Canada, OECD Working Papers on Finance, Insurance and Private Pensions, No.32

Action 5: Minimise policy and regulatory risk and ensure optimal risk allocation

Political and regulatory risk are major deterrents to energy investments and are misallocated onto the private sector.

Energy leaders agreed on the broad roles needed to increase energy investments and transform the energy sector:

- Policymakers must set the right frameworks for investment so that investors can clearly identify the risk-return potential.
- The private sector must provide the bulk of capital necessary to expand energy access, develop new technologies, replenish ageing infrastructure and build new energy infrastructure assets and associated supply chains.
- Policymakers and industry leaders – across all energy sectors and in all geographic regions – recognised that the single best mechanism to drive investment is a stable, predictable policy framework. Policymakers should avoid making changes in regulation that could create policy and regulatory risk.

While policymakers and energy leaders agree on the key roles for energy investment, political and regulatory risk remain a major deterrent to energy investments. This point was stressed by the energy industry in the 2012 World Energy Trilemma report and was further echoed by many of the policymakers interviewed in 2013. A brief WEC and Oliver Wyman survey of energy industry leaders found that regulatory/policy risk and country risk (for example, expropriation, civil war, and deteriorations in the rule of law) are the two biggest risks to have a negative impact on energy investment. Respondents also noted that these risks lie disproportionately with the private sector. Under the right risk alignment framework, the majority of political risk would be borne and managed by governments – with investors assuming the smallest amount of political risk.

Policymakers must consider the impact of shifting energy policies on the investment climate and flow – for example, the impact of broad political declarations to substitute one form of energy for another as part of investment plans. Countries should also look for ways to ensure governments can be a more stable partner for investors in terms of providing a predictable policy framework. Some countries have embedded elements of energy policy into legal agreements; elsewhere, political parties have come together to agree on the country's energy policy to provide stability.

Best-practice guidelines on how best to determine the appropriate allocation of risk among the various players – building on past projects, particularly public-private partnerships – should be considered. Multilateral organisations (development banks, for example) could take a lead on developing this guidance.

Action 6: Market-based approaches to carbon pricing to drive investments

A carbon price needs to be complemented by carefully implemented energy-efficiency measures, policies and technology.

One of the critical uncertainties identified by energy leaders is the lack of a global climate framework or a clear perspective on carbon pricing. Policymakers acknowledge that, in the absence of a regional or global consensus on climate change, it will remain difficult for the energy sector – both private and public – to determine what its activities and direct investments should be. For example, without an appropriate price on carbon emissions and the right policy frameworks, technologies such as carbon capture and storage are at risk of being seen as simply an added cost. The private sector clearly recognises that something must be done, but there is too much uncertainty about when, how much and which particular aspect to focus on.

The 2012 and 2013 interviews noted that market-based instruments are considered to be most effective in driving changes in the energy system, and that a carbon price or tax on CO₂ emissions from energy can be an important (but insufficient) tool to support the transition to low-carbon energy systems.

Other supporting mechanisms include:

- advancing energy efficiency in commercial and residential buildings
- escalating fuel efficiency standards for vehicles and other modes of transport
- improving transmission and distribution network technologies
- energy mix targets such as renewable portfolio standards
- phasing out fossil fuel subsidies
- dynamic, transparent and flexible energy pricing.

Taken together, such support can drive rational market behaviour and lead to cumulative reductions in energy use and carbon emissions. However, these kind of mechanisms are difficult to harmonise globally and do not address the global displacement of manufacturing and resulting carbon emissions.

Smart thinking is needed on the roles of the market and government in finding a way to set an effective carbon price which is responsive to market conditions.

Currently, over 40 national and sub-national jurisdictions, including most OECD countries, have either implemented or are considering mechanisms that put an explicit price on carbon. This directly influences the relative cost of goods and services.⁹ Many more countries have implicit carbon prices through other measures such as direct regulation of technologies, renewable energy targets, or subsidies for low-emission technologies. While a carbon price set at the right level helps promote low-carbon investments and drive innovation into green technology, a carbon price that is too low may have unintended consequences. For example, the European Union (EU) carbon price is now almost 10 times lower than was expected when the Emission Trading

⁹ The World Bank, 2013: Mapping Carbon Pricing Initiatives

Scheme (ETS) was agreed in 2008.¹⁰ It has been suggested that other measures at EU level, in particular the legally binding target for 20% renewables by 2020, has been a factor. This highlights that the rules governing the energy sector must take into account the interactions between regulations, including, for example, the impact of concurrent regulated markets for renewable power and a non-regulated market in thermal power.

Developing or revising carbon markets based on know-how and experience may prevent the repetition of mistakes and help create better cross-border market opportunities. There are also a number of issues that need to be considered carefully, including different plans and designs for systems, the transfer of problems from one system to another, or the distribution of transnational powers and competencies.¹¹

As carbon markets continue to emerge in countries across the globe,¹² best practices must be identified to increase the effectiveness of supporting reducing the cost of cutting emissions, increasing market liquidity, levelling the international playing field and supporting global cooperation on climate change.

Action 7: Design transparent, flexible and dynamic pricing frameworks

Energy systems which do not cover their costs over the medium- to long-term are not sustainable, and long periods of low prices may jeopardise future energy availability.

The governance regimes for energy prices must be designed to enable rational market behaviour – that is, undistorted, responsive to cost changes and flexible so that the market can work. Transparent, flexible and dynamic energy pricing frameworks are critical for attracting investment, increasing energy efficiency, changing energy consumption patterns, developing renewable energy, improving access to new supply options, and driving innovation.

Today there are already a number of countries worldwide with transparent, flexible and dynamic energy prices in place, and many others planning the introduction of cost-reflective energy prices. In the Southern African Development Community, the introduction of cost-reflective tariffs is viewed as a great opportunity to attract foreign investment and provide more people with access to modern energy services.

However, many countries are trying to correct the distortions in pricing of energy goods and services that can have a negative impact on balance sheets or cost recovery, and so discourage investment. For example:

- generous subsidy schemes that lead to wasteful use of energy
- controlling retail prices, leaving suppliers exposed to rising wholesale prices.

¹⁰ Hall, F, 2013: Carbon price 'too low' to stimulate green investment (18 April 2013, www.publicserviceeurope.com)

¹¹ Wettestad, J, Jevnaker, T, 2013: The EU's Quest for Linked Carbon Markets: Achievements and challenges

¹² After Norway, Liechtenstein and Iceland connected their ETS to the EU in 2008. In 2009 the EU expressed the ambition to have carbon markets linked OECD-wide by 2015 and with developing countries by 2020. Several linkages are already under discussion or planned. For example, in 2012 the EU and Australia agreed on a pathway to link their two schemes by July 2018. Negotiations are also underway between the EU and the Swiss ETS. There are also attempts to make the California and EU ETS compatible, and linking ambitions towards Asia, in particular China and South Korea.

Long periods of low prices may jeopardise future energy availability. Therefore, energy systems which do not cover their costs over the medium- to long-term are not sustainable. Regulation must take this into account and provide the stability and transparency to attract investment. To avoid the political pressures that deflect governments from implementing and supporting cost-reflective pricing, there must be greater public understanding of decarbonisation and why it can increase energy prices.

Action 8: Drive (green) trade liberalisation

A global trade and investment regime that leverages investment, innovation, and technology is needed.

Energy-related technology, resources and skills are unevenly distributed across the world and are often not available in places where they are most urgently needed. The sheer volume of resources and investment necessary to improve energy access and address climate change appears staggering, but the cost may be reduced dramatically by improving technology. Therefore, promoting the development and dissemination of technology in the energy sector globally is critical.

A coordinated and collaborative approach to international policy convergence is required. If nations adopt 'protectionist' measures that lose sight of the global picture, such as quotas, patents and tariffs, this will be delayed. The result will be a highly uncertain investment framework, making infrastructure investments unnecessarily risky. Technologies important for the environment will also be prevented from spreading, especially to emerging, developing, and least-developed economies.

Robust environments that enable the development of technology are needed, including an appropriate global trade and investment regime that allows and leverages investment, innovation, and technology uptake.

To advance global integration, improve market access and overcome trade barriers, international agreements such as the 2012 agreement of Asia-Pacific Economic Cooperation (APEC) members, serve as leading examples in a period marked by international disputes over energy subsidies and other protectionist measures. Other regional economic and trade platforms, such as the Economic Community of West African States (ECOWAS), have the ambition to achieve the same.

Promote public and private initiatives that foster RD&D and innovation

Action 9: Meet the need for more RD&D

Research, development and demonstration are critical to achieve current energy goals and post 2030–2050 needs.

Energy leaders in the public and private sectors agree that more RD&D is needed to transform the way energy is produced and used to ensure security and mitigate environmental impact and greenhouse gas (GHG) emissions. In addition, technologies must be developed to rapidly expand access to reliable energy.

However, funding for RD&D is challenging as cash-strapped governments face a range of competing demands and have limited funds available to support a shift to an

efficient and low-carbon future. Therefore, policymakers called on industry to lead in taking more calculated risks when it comes to innovation as well as RD&D of new energy technologies and renewable energy sources.

Business leaders agreed that there are opportunities for greater leadership but noted that public sector assistance is needed – in investments and facilitating and coordination of efforts – particularly where there is a limited market push for specific research and where a project is primarily for public benefit. However, joint public-private RD&D projects also raise two critical questions:

- How to effectively align upside and downside risks?
- Who owns the resulting intellectual property?

To overcome these hurdles, government and business leaders should first identify the greatest technology challenges, for example, energy storage or how to improve energy efficiency. Once the key challenges are identified, efforts can be prioritised to stimulate the next generation of technology for energy needs and challenges post 2030–2050. These can include creating opportunities and facilitating cross-industry sector consortia at a regional, national, or global level. Examples of such collaborations already exist and include industry consortiums on pre-competitive RD&D, such as Canada's Oil Sands Innovation Alliance (COSIA) or the Joint Center for Energy Storage Research (JCESR). Industry-led joint collaborative RD&D initiatives help distribute the risk and cost among the players involved, and are better able to attract national or regional level government support and funding.

Box 3: Joint Center for Energy Storage Research (JCESR)

In late 2012 a multi-partner team led by Argonne National Laboratory was awarded up to US\$120 million over five years, alongside a US\$35 million commitment for a new facility from the State of Illinois (United States), to establish a batteries and energy storage hub in Chicago, Illinois. The JCESR – a public-private partnership – will combine the research and development of five United States Department of Energy (US DOE) national laboratories, five universities, and four private firms in an effort aimed at advancing next generation battery and energy storage technologies for electric and hybrid cars and the electricity grid. The target is: five times cheaper, with five times higher performance, within five years. A number of venture capital firms active in the clean-technology arena serve on an advisory panel to help focus the research on commercially interesting opportunities.

Advancing battery performance is a critical element of the goal to reduce reliance on foreign oil, thus increasing the country's energy independence, and to make green energy more available and affordable for consumers. The partnership brings together leading scientists, engineers and manufacturers, integrating efforts at several successful independent research programmes.

The project promises to deliver the new technologies and scientific approaches to transform the battery and energy storage industry and spur commercial innovation. It will also significantly boost the Illinois economy by creating new jobs and growing manufacturing in the region.

Action 10: Encourage joint pre-commercial industry initiatives, including early large-scale demonstration and deployment

Demonstration and deployment of large-scale technology needs coordinated government support to enable better use of limited funding.

Industry leaders pointed to an additional area where more government support is needed to make progress and meet the energy needs and challenges post 2030–2050: the demonstration and deployment of large-scale technology, for example, carbon capture and storage (CCS), or smart grids.

The necessary size of demonstration projects means costs and risks are simply too high for a single company to bear, making greater government support for pilot and demonstration projects critical. Industry recognised the limited availability of government funding and encouraged coordination of countries to ensure the optimal use of capital available. For example, one success story identified by industry leaders is the European CCS Demonstration Project Network, established in 2009 by the European Commission to accelerate the deployment of safe, large-scale and commercially viable CCS projects. The network is an international community of leading demonstration projects committed to sharing knowledge and experiences. Its united goal is to achieve safe and commercially viable CCS. The learning is disseminated to other projects, stakeholders and the public to help gain acceptance of the technology and support CCS to achieve its full potential. The network expects that CCS will be able to stand on its own feet in an ETS-driven system as soon as 2020.

Conclusion

There needs to be a more honest and realistic public debate focused on the opportunities and possibilities that lie within change.

The WEC's World Energy Trilemma 2012–2013 research programme focused on how to break out of the current energy trilemma. Tapping into the insights of 100-plus global energy leaders resulted in the identification of 10 jointly acknowledged priority action areas. While many of these action areas have been highlighted by other organisations, the WEC's efforts uniquely capture the jointly identified priorities of global energy leaders from public and private sectors, and from developed, emerging and less developed nations. For political decision makers and the energy industry, this report is the Agenda for Change, a call to action by peers and colleagues.

The World Energy Trilemma reports must serve as a catalyst in building honest and realistic debates, sharing best practice and fostering a clear vision for sustainable energy. The WEC, with its broad membership base, is ready and positioned to provide the platform and forum to drive forward the Agenda for Change.

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The World Energy Council (WEC) is the principal impartial network of leaders and practitioners promoting an affordable, stable and environmentally sensitive energy system for the greatest benefit of all. Formed in 1923, WEC is the UN-accredited global energy body, representing the entire energy spectrum, with more than 3000 member organisations located in over 90 countries and drawn from governments, private and state corporations, academia, NGOs and energy related stakeholders. WEC informs global, regional and national energy strategies by hosting high-level events, publishing authoritative studies, and working through its extensive member network to facilitate the world's energy policy dialogue.

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