C.I.R.E.D.
CENTRE INTERNATIONAL DE RECHERCHE SUR L'ENVIRONNEMENT ET LE DÉVELOPPEMENT

Regulations versus Free Energy Markets

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WEC Europe Regional workshop « Energy Picture of Europe 2050 »
6-7 december, 2011

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Roadmap 2050:80% domestic reduction in 2050
Efficient pathway: -25% in 2020 -40% in 2030 -60% in 2040

Need of additional Investment

- **Additional domestic investment**: € 270 billion annually during 2010-2050, equivalent to 1.5% of GDP, of which key investments are in energy demand sectors
  - power sector and industry: € 35bn
  - built environment (buildings, appliances): € 75bn
  - transport (vehicles and infrastructure): € 150bn

Content

- **1. Energy technologies and infrastructures: the long term market inefficiency**

- **2. 2. Public policies needed in the electricity markets in view of decarbonisation**

1. Energy technologies and infrastructures: the long term market inefficiency

- Values 1 : short term efficiency, reducing costs, lower price, opening consumer choices
- Values 2: Long term goals: innovation, long term security of supply, sustainability, climate, long term availability (fuel resources),
- Current policies /institutional regime reflects values 1 at the detriment of value 2
- How value 2 could be secured?
  - With unbundling, de-integration, competion policies
  - Beliefs that market could deliver long term technologies and infrastructures

1.1. Market failures and long term inefficiency

- **Markets can provide strong incentives to short term efficiency**
  - (short term coordination in electricity generation)

- **But markets create risks**
- Risks raise the cost of capital ; so no capital intensive intensive
  - Despite what Capital asset Pricing Model could say about diversifiable risk

- **But market could not deliver for long term goals**
- Need of public support for innovation RD and learning
- Need of public coordination with long term view for development of infrastructures and large upfront costs investment
- Investment can be "de-risked" through greater public intervention
- If policy interventions, need of clarity for long term investments: stability of policies for no other risks (ex. Carbon regime)

- **But Market could not deliver for innovation and learning investment**

1.2. Complementarity of overall planning and market

Necessity **to produce a long term planning generation and demand-side resource mix out** that is consistent with decarbonisation and long term security objectives

To underpin the strategic development of the network.

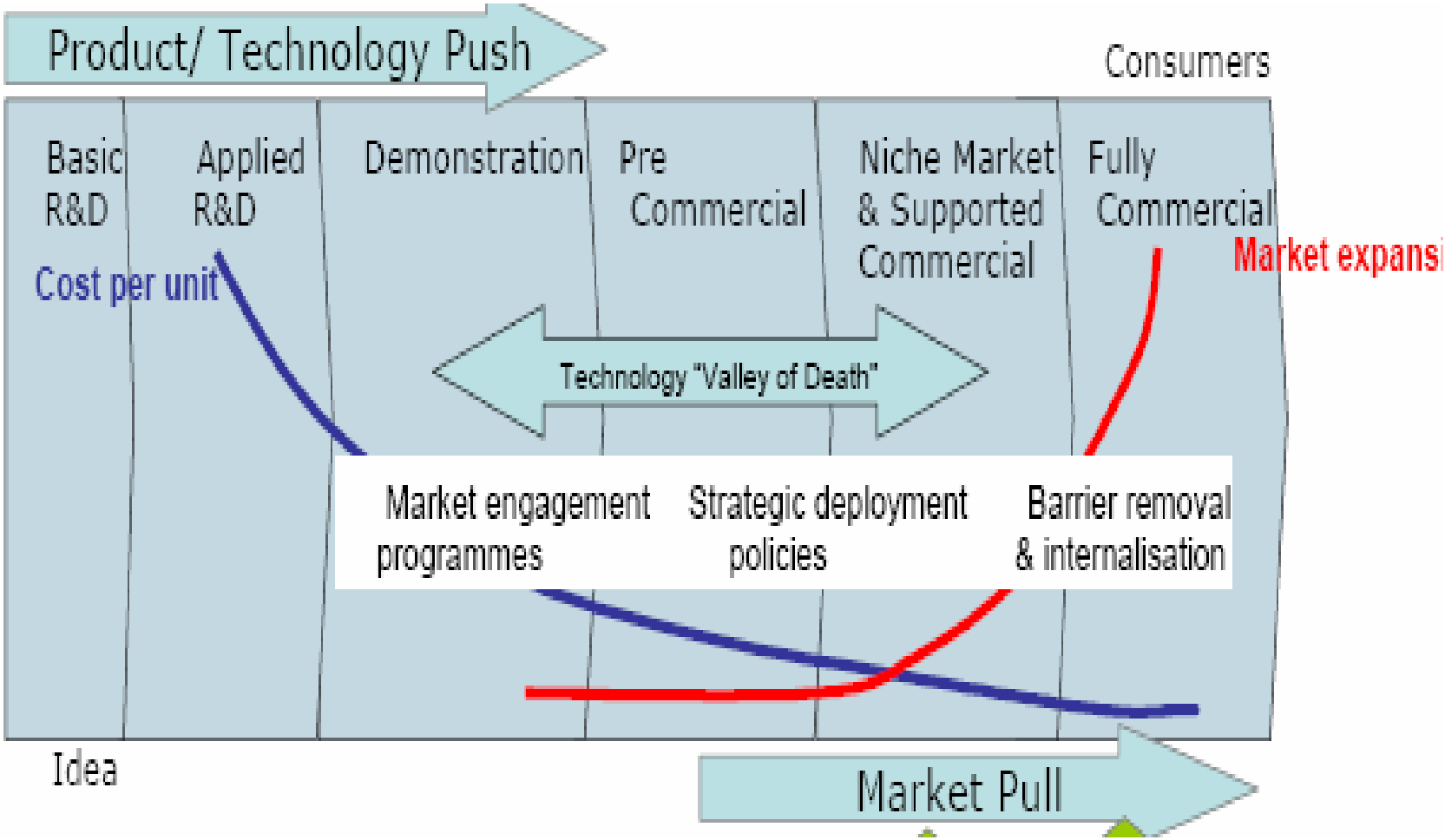
It is not as a move away from the market and toward central planning

However, decarbonised, reliable and affordable power sector relies on the development of **resources that may not be developed without a coordinated strategic view** and a public support

1.3. Innovation : RD&D et deployment

- Innovation is essential to develop the required new technologies.
- Without effective policies to alleviate the private costs of innovation (no appropriation of social benefits), there will be underinvestment in R&D.
- Idem for the balance between the learning cost and externalities of learning
- In the learning process, path dependencies due to institutions, risk-aversion , network effects and improvement of incumbent technologies prevent a quick roll out.
- Learning investment are crucial
- Some technologies require a completely new underlying infrastructure. (CCS)

They should cross the « death valley » to be economically ready when carbon price becomes high



Barriers to learning investment and the precommercial deployment

- **With CCS systems, nuclear** (re-learning) **and off-shore windpower** (at a less extent)
  - Technological uncertainty
  - Innovation chain is too long , too complex and imperfect to be driven by price anticipation for any low carbon technology
  - **Electricity market risks**: *risks are on the producers*
  - *On CCs project "The most important part of the whole story is that we are operating in a liberalized power market "(L. Stormberg, Vattenfall, 2008).*
  - Uncertainty on climate policy and the long term price of carbon
  - Uncertainty on the price of fuel
  - The high upfront cost and long lead time: need of revenue foreseeability/stability

1.4. Energy efficiency : innovative financing

- **Energy efficiency policy is needed to overcome market failures in all sectors**
- The key role of information
- **Role of standards** (and obligation on manufacturers : automobile and CAFE)
- **Financial incentives with innovative financing**
- Obligation on energy suppliers
- The role of local communities, cities, administrations

Example of KfW's Support for Energy Efficiency in Residential Buildings

Importance of retrofit and insulation in the German « Energy Concept »

– 2% Retrofit rate and each retrofit has to be deep

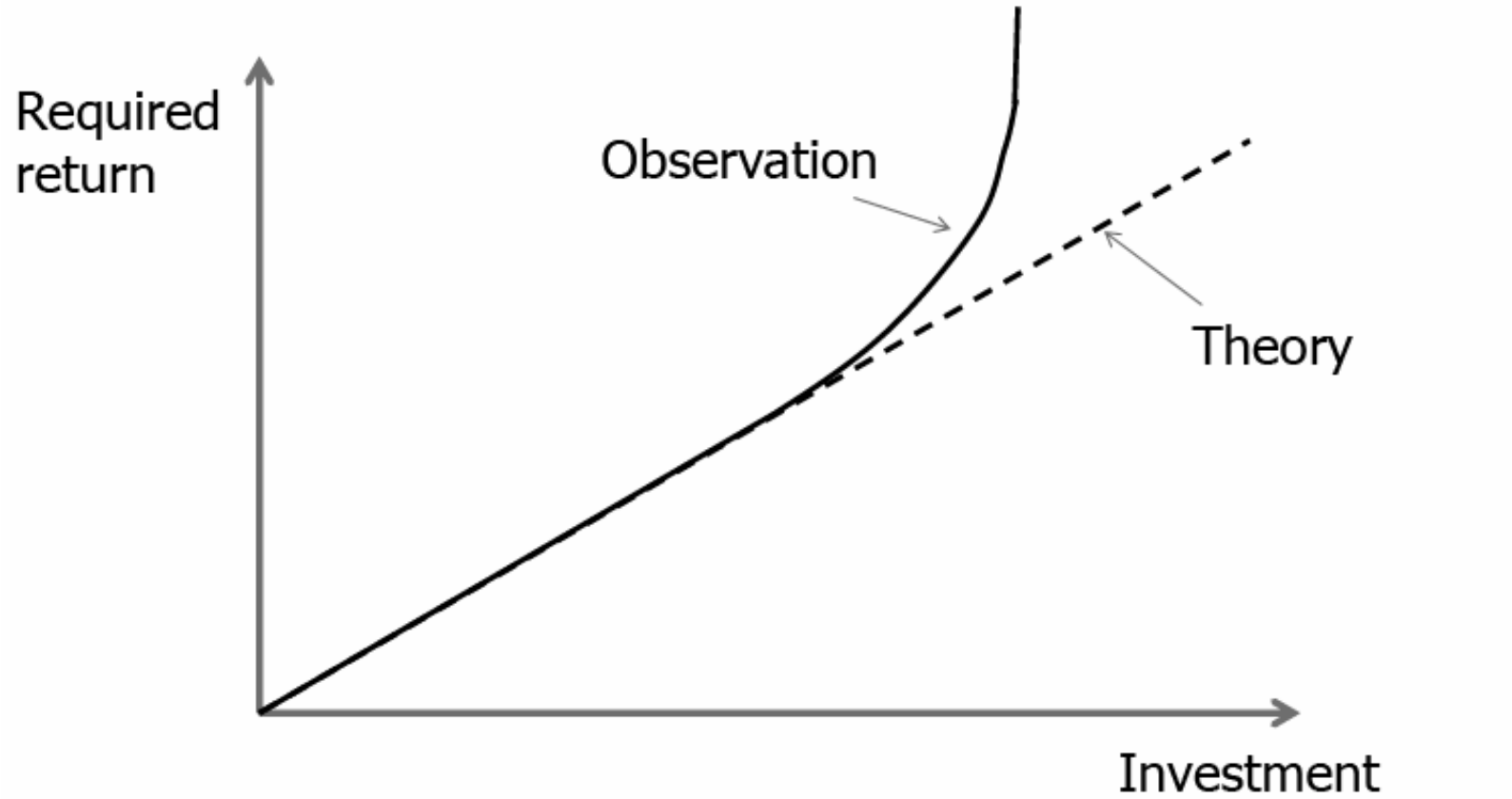
- KfW a public bank
  - Financed mainly through bonds / partially government
  - ½ of its loans to habitation
  - **80% of total support in Germany in insulation program**
  - Higher retrofit depth / higher support

- Example of support conditions:
  - Retrofit to KfW 100: 2.57% fixed interest, 5% loan relief
  - Retrofit to KfW 55: 2.57% fixed interest, 12.5% loan relief

1.5. Need of long term arrangements to manage risks for getting finance

- Development of capital intensive equipment in low carbon technologies
  - Risk shifted to the producers with market regime
  - Important risk premium

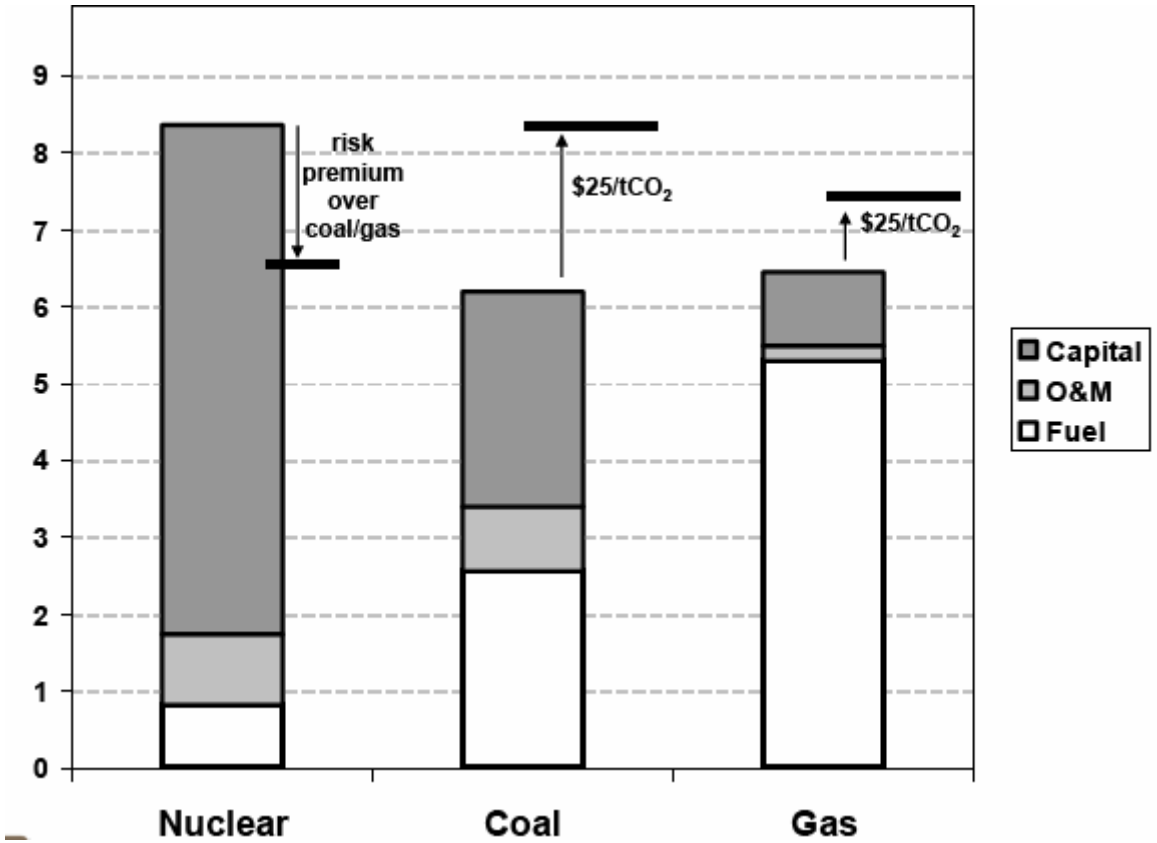
Reality of investment of energy companies under financial governance



Effect of risk premium on large investment (nuclear case)

Nuclear could be competitive if risk premium of 3% in loan could be suppressed,

(Source : 2009 MIT report update . Reference to 3500-3800 $/kW)



NB: Risk premium eliminated : nuclear cost decreases from 8.4 to 6.6 ¢/kWh and becomes competitive with coal and gas at $7/mmBtu), even in the absence of carbon charge.

2. Public policies needed in the electricity markets in view of decarbonisation

- Power sector key to ‘decarbonise’ the economy

  CCS , Nuclear and large sized renewables would displace coal- and gas fired generation and follow demand growth countries

- Low carbon technologies in power generation :
  - Capital intensive (large-sized as well as low-sized)
  - Major low carbon technologies are still in the innovation process:
    - the problem of crossing the death valley
    - Old new technology need re-learning and radical safety improvement
- No adequation of present market regime of electricity system with characters of low carbon technologies
  - Need of subsidization to production (example of FIT stab le on 15 y)
  - Need of new sharing risk
  - Need of government monitoring of transition

Policies will increase market disqualification and self-maintain the need of regulation

- Induced effects of variable production windpower and solar development pulled by FIT
- low/unpredictable market prices driven by high levels of low-running-cost low-carbon plant after deployment with subsidization (windpower, nuclear, CCS)
  –

- A market has two main roles:
  – Short term signal for merit order and scarcity
  – Long term signal of need for investment and (hopefully renumerate it

- Extensive wind has two price effects:
  – reduces average price
  – Makes price very volatile

- This undermines role of market for the long term with two issues
  – low term supply security
  – Investment in capital intensive equipment

The inefficiency of carbon price signal in electricity market regime

EU ETS price 2005-2008

- CO2 permit Price volatility
- **Uncertainty on climate policy and the price of carbon after the 3rd period and in the Post Kyoto**
- No way to anticipate obsolescence of existing carbon equipment
- Uncertain competiveness of low carbon options (CCS, nuclear ,wind offshore

Policies of technology deployment in the market

From adaptation of market regime to…

- Investment support:
  - Direct subsidy/tax credit
  - Subsidy by a dedicated trust fund (for instance for CCS)

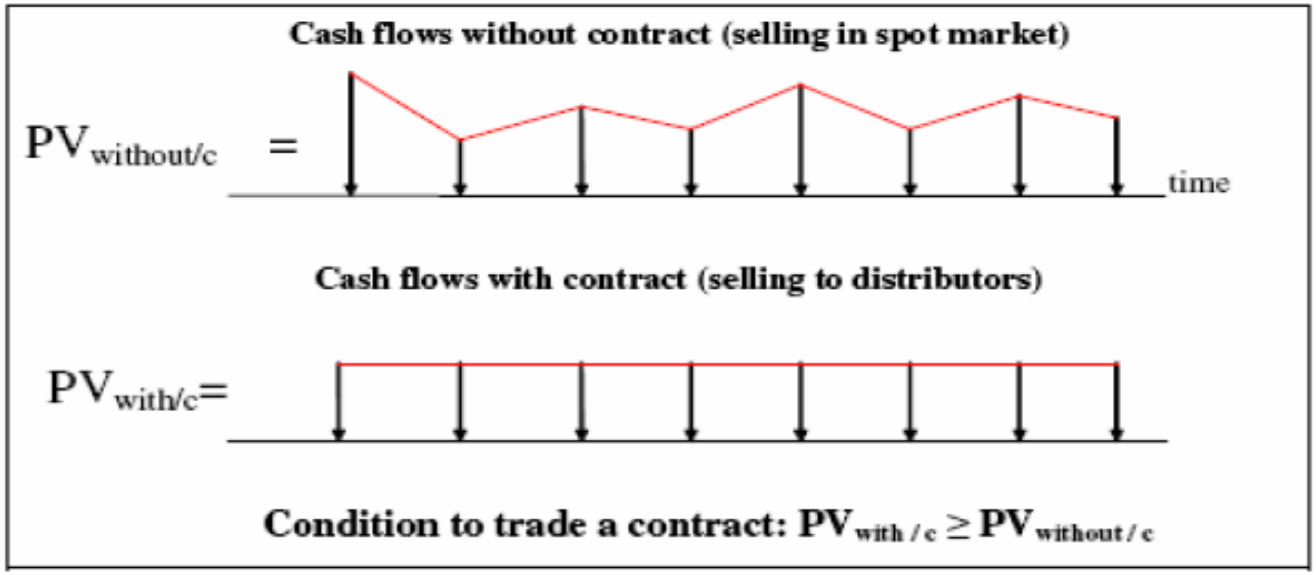
- Mandate
  - obligation on carbon plant to be equiped by CCS from 2020(emissions standard on coal)
  - Low carbon portfolio obligation

- Subsidy to production: COST and RISK on state and consumers
  - Feed in subsidies (with an obligation to purchase by distributors or historic suppliers
  - Guarantee CO2 price for CCS, nuclear, Windpower(option contract with government)
  - Long term contract s on physical electriciity or option contracts with public agency

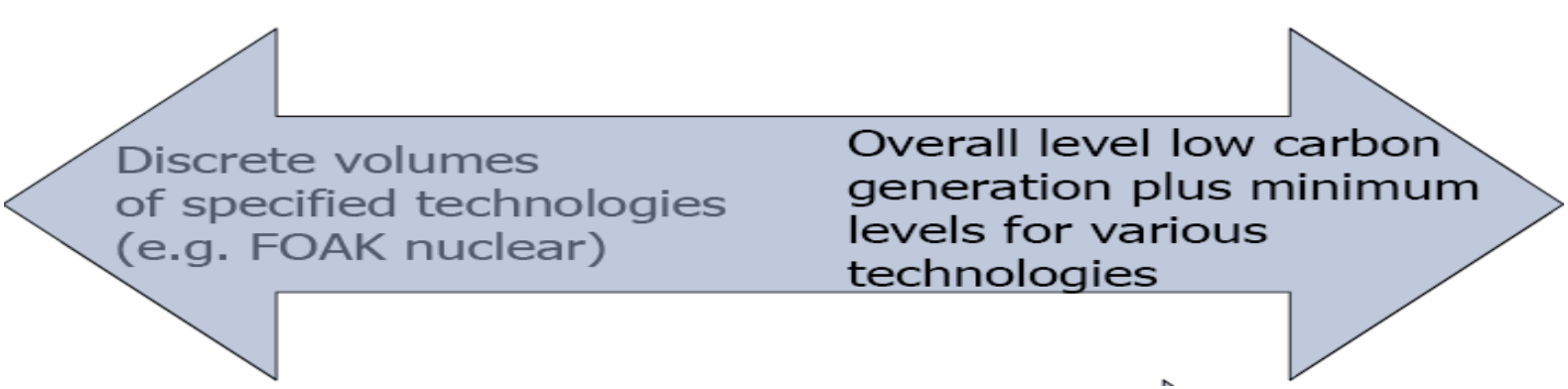
Intervene to transfer risk directly from investors to consumers

How?

Through signing long term contracts



… to dramatic change of market regime



- **From tender for some volumes of RES, nuclear and CCS**

  to Tender for all low carbon capacity

  – Type (and perhaps location) specified

  Less and less market share for non supported electricity: **an implicit paradigm shift**

  Market only for operational coordination: Capacity continues to compete day-to-day

Some new issues

As Risks are shifted to the State and finally paid by consumers…

- Which risks are best allocated to State / investor / operator?
- Risks of planning errors

- Capture of the regulator:
  - influence of new constituencies on the design of instruments

- Design of instruments to be relevant to the maturity of technology (examples of PV feed-in tariffs)

- Design of instruments to be preferred: those who do not add risks

There is an inherent contradiction between the market spirit behind some directives and the Competition policy and the pursuit of long term goals

3. Conclusion for relevant scenarios

- If The Roadmap 2050 is taken as a relevant example, this scenario not reachable without sound reforms

- Market could not deliver in electricity and gas markets low carbon technologies and investment in infrastructures (network and building)

- Few would happen without recognition of a large role for public coordination
  - Leaving coordination entirely to the market might result in late deployment and fragmented networks and markets.
  - Dramatic stake of changing institutions and regulation

- Scenarios must clearly be dissociated between
  - those with market based market oriented and
  - those with strong governance, public coordination and hybride regime

Annex

Need of long term arrangements to manage risks for getting finance

- Development of infrastructures under long term coodination:
  - HV lines, supergrid, interconnexion
  - Natural monopoly and regulation
  - Easier to finance than production investment
  - Model of merchant lines valuable in context of mature network
  - But important need for coordination forsupergrid, interco and gas pipes lines, etc.
  - specific risks of social acceptability

- Development of capital intensive equipment in low carbon technologies
  - Risk shifted to the producers with market regime
  - Important risk premium