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Improving international cooperation for developing smart grids

Patrice Geoffron

Professor, University Paris-Dauphine
Director, CGEMP
(Research Center in Energy and Utilities Economics)
patrice.geoffron@dauphine.fr

OSCE

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Vienna, 7-8 February 2011

Summary

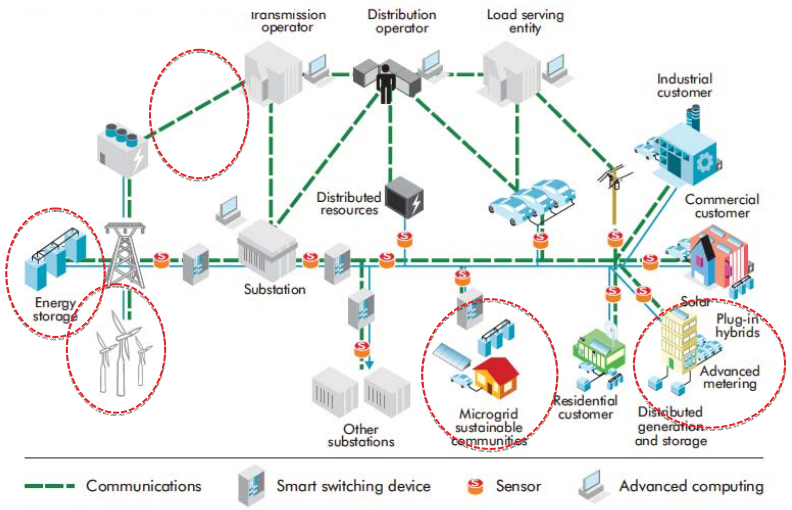
Background

- ☑ **Electricity demand is increasing in OECD and moreover in non-OECD countries.**
- ☑ **Use of electricity is spreading to new sectors.**
- ☑ **Increasing share of intermittent and variable energy sources.**
- ☑ ***Classical grids can not meet these challenges.***
- ☑ ***Huge needs of investments…***
- ☑ ***… but moreover of international cooperation to reduce the technological and economic uncertainties***

Definition

- ☑ "*A Smart Grid is an **electricity network** that uses **digital technology** to monitor and manage the transport of electricity from all generation sources to meet the varying electricity demands of end users.*
- ☑ *Such grids will be able to **co-ordinate the needs and capabilities** of all generators, grid operators, end users and electricity market stakeholders…*
- ☑ *…in such a way that it can optimise asset utilisation and operation and, in the process, **minimise both costs and environmental impacts** while maintaining system reliability, resilience and stability."* [IEA ETP 2010]

In summary



Source: Wang (2009).

Summary

- Smart Grids: What is it?
- **Smart Grids: What is it for?**
- Smart Grids: What are the problems?
- Smart Grids: What is to be done?

Factor driving Smart Grids

Regulatory Mandate	Future Gen Mix	Ageing Grid and Reliability	Customer Needs	Environmental Impact	Technology Evolution
• EU and US climate change **legislation is forcing companies to implement smart technology** • United Kingdom mandate for residential **national roll-out of smart metering** by 2020 • **US$ 4.5 billion US fiscal stimulus** allocated to smart grid – number of states now planning pilots • Rapidly developing **EU policy** re. Smart Grid	• Deployments of **renewables and distributed generation** technologies will affect the design and operation of the distribution network leading to increasing need for automation • **Plug-in hybrid vehicles** are likely to further increase the stress on the distribution network • **Low-carbon technologies** will mean the energy grid will need to be able to deal with **intermittent generation and drive need for demand management**	• **Massive investment** will be needed to upgrade the transmission and distribution grid over the next 10 years to meet new low-carbon energy requirements • All new network upgrades will include the introduction of **sensors and controls** to enable efficiency and improved management • "The total estimated annual cost to the US economy from **power outages** and **power quality disturbances** is over US$ 100 billion…" which can be saved through smart technologies	• Under **rising costs of energy**, customers are likely to demand a more granular level of information to **reduce their bills** • Consumer energy awareness and demand for **sustainability** will require an enhanced ability to measure and **manage use** • The use of more **flexible pricing mechanisms**, such as Time of Usage and Critical Peak Pricing, will **require automation**	• The enabling of energy demand management to reduce consumption – **peak shaving and load shifting** will require more control in the home • **Carbon emissions reduction will** drive the need for more information to enable energy efficiency • Government refunds will require more **monitoring of carbon emission** savings for auditing purposes	• Increased use of smart technology is increasing data volumes and driving the need for high-speed analytics • Automated meter reading is quickly becoming **obsolete** as energy companies move to advanced metering infrastructures • In the face of new capital investment, **smart grid components** are becoming **increasingly cost competitive**

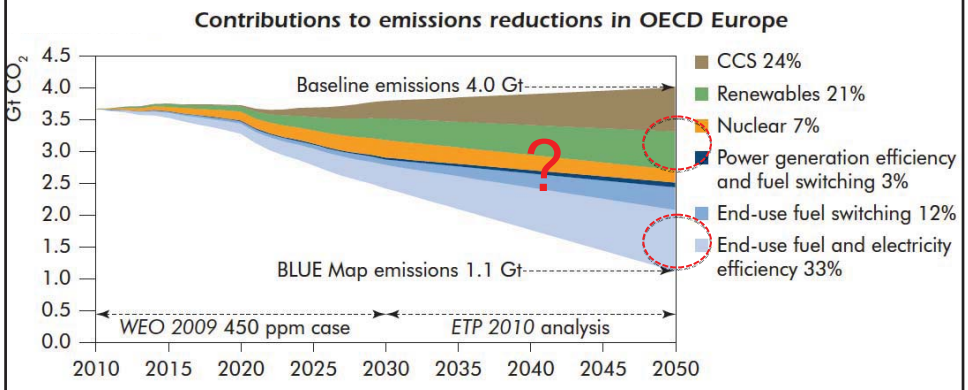
Source: WEC-Accenture

Potential benefits

Government and Regulators	Utilities
1. Opportunity for GDP uplift and green-collar job creation 2. Effective carbon abatement investment option 3. Security and reliability of energy supply improved 4. Creation of low-carbon regulatory frameworks accelerated 5. Spending efficiency increased by providing options to rationalize national infrastructure investments	1. Wider portfolio of generation options 2. Grid efficiency, reliability and understanding of power flows increased enabling operational/maintenance savings 3. Opportunity to transition from a commodity provider to a service provider 4. Creation of new revenue channels and ways to improve customer service 5. Opportunity to evolve the operating model and lower operating costs
Vendor	**Consumers**
1. Opportunity to collaborate with other participants in the value chain to gain market access 2. Opportunity to create new products and services to take to market e.g. further broadband business development for telecom operators 3. Ability to improve understanding of consumer behavior 4. Cost of delivery reduced through mass deployments 5. Opportunity for a machine-to-machine platform that can service multiple industries	1. Greater choice between energy providers, products and services 2. Greater transparency and control over energy consumption 3. Opportunity to see environmental benefits on a household/business basis 4. Access to clean technologies, such as electric vehicles and micro-generation 5. Provision of a more reliable service with potential energy bill and carbon savings

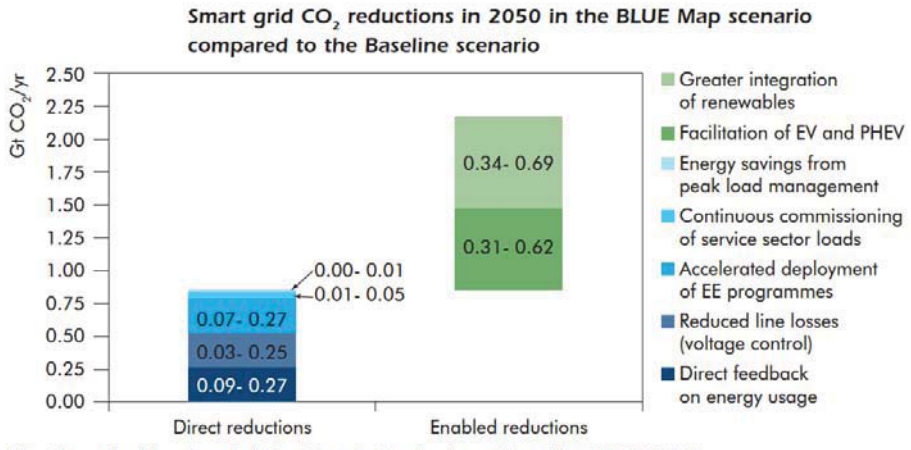
Source: WEC-Accenture

The efforts to be made up to 2050 require SG



Source: IEA

Potential CO_2 reductions related to SG



Note: The methodology for calculating CO_2 reductions has been adapted from EPRI (2008).[9]

Source: IEA

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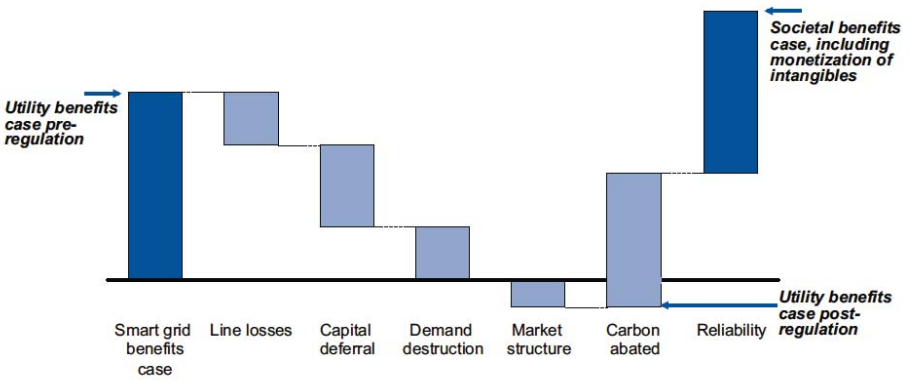
How to finance the R&D?

Estimated global gaps in public low-carbon energy RD&D

	Annual investment in RD&D needed to achieve the BLUE Map scenario outcomes in 2050	Annual public RD&D spending	Estimated annual RD&D spending gap
	(USD million)[1]	(USD million)[2]	(USD million)
Advanced vehicles (includes EVs, PHEVs + FCVs; energy efficiency in transport)	22 500 – 45 000	1 860	20 640 – 43 140
Bioenergy (biomass combustion and biofuels)	1 500 – 3 000	740	760 – 2 260
CCS (power generation, industry, fuel transformation)	9 000 – 18 000	540	8 460 – 17 460
Energy efficiency (industry)[3]	5 000 – 10 000	530	4 470 – 9 470
Higher-efficiency coal (IGCC + USCSC)[4]	1 300 – 2 600	850	450 – 1 750
Nuclear fission	1 500 – 3 000	4 030	0[5]
Smart grids	5 600 - 11 200	530	5 070 – 10 670
Solar energy (PV + CSP + solar heating)	1 800 – 3 600	680	1 120 – 2 920
Wind energy	1 800 – 3 600	240	1 560 – 3 360
Total across technologies	**50 000 – 100 000**	**10 000**	**40 000 – 90 000**

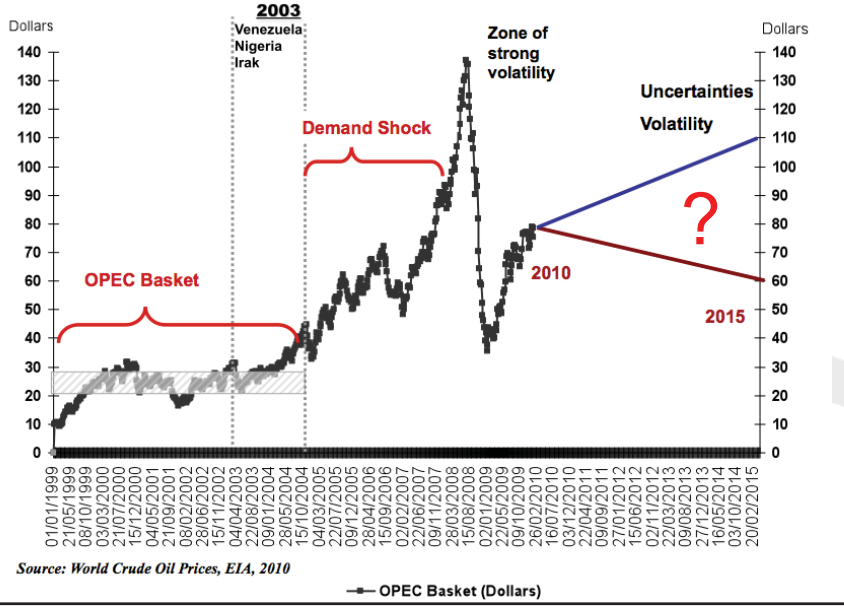
Source: IEA

How to include social benefits in business models?



Source: WEC-Accenture

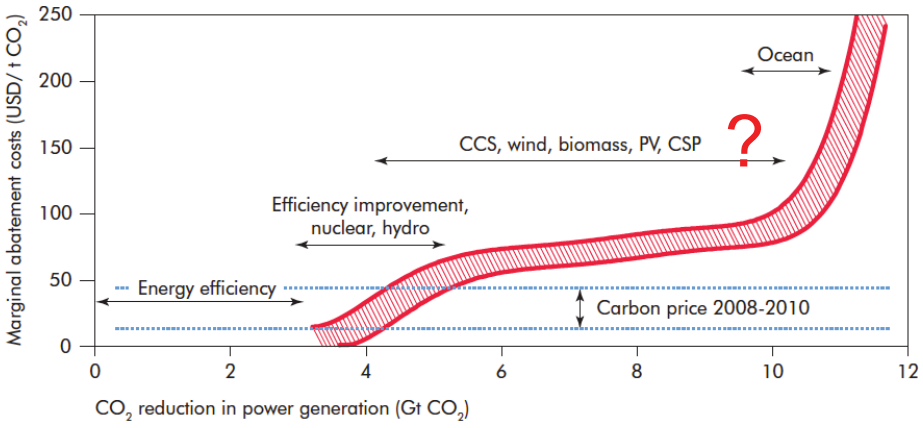
How facing uncertain price signals for fossil energies?



Source: World Crude Oil Prices, EIA, 2010

How facing uncertain price signals for CO_2?

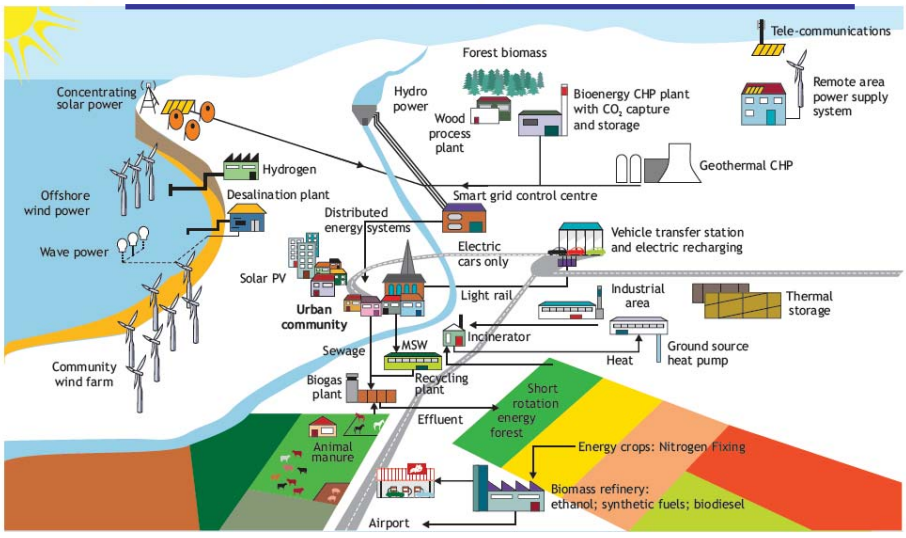
CO_2 mitigation costs in the electricity sector (2010-20) and current CO_2 prices



Source: CO_2 price data from the European Climate Exchange; accessed at www.ecx.eu.

Source: IEA

How to transform "cities" in "smart cities"?



Source: IEA

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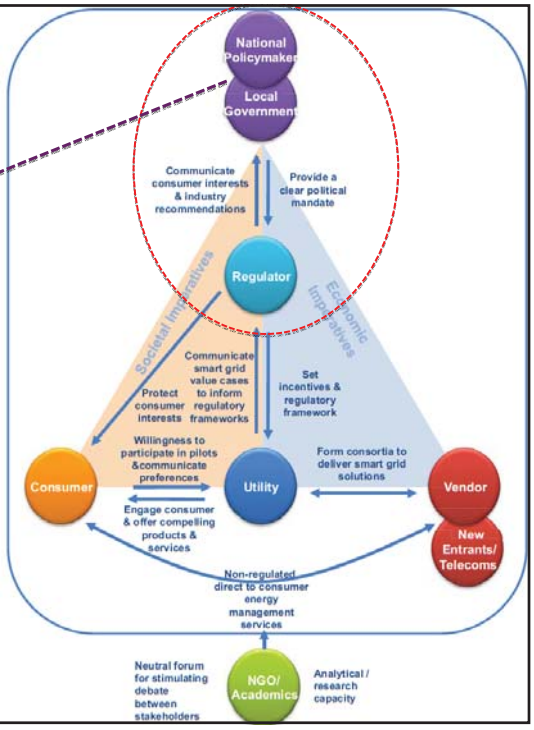
Public authorities have a specific role to reduce the economic uncertainties and security risks perceived by private investors

The coordination framework



Source: WEC-Accenture

Various relevant areas for international cooperation

- ☑ *Common R&D projects, pilots, …*
- ☑ *Sharing information on national experiences results*
- ☑ *Discussions around regulatory tools*
- ☑ *Definition of norms*
- ☑ *Network security issues*
- ☑ *…*