



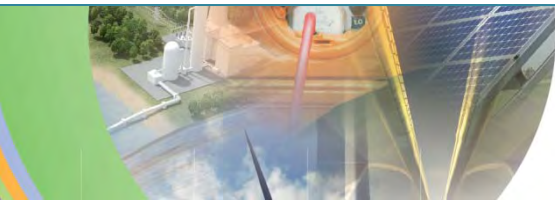
# Developing a Common Vision for the Grid of the Future

**David Elzinga**  
*June 23, 2010*

Low-carbon energy technology roadmaps

# I can't stand the word "Smart"!!

- Smart Grids, Smart meters, Smart consumers, Smart utilities, Smart Communities, Smart Ecosystems.....
- Smartening of the grid?
- Does the grid need to be Smart?
- Smart grids are better than dumb grids – **BUT**
  - What are they?



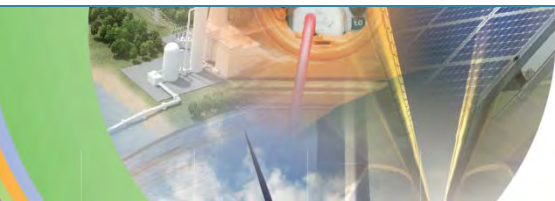
# What is the Smart Grid?

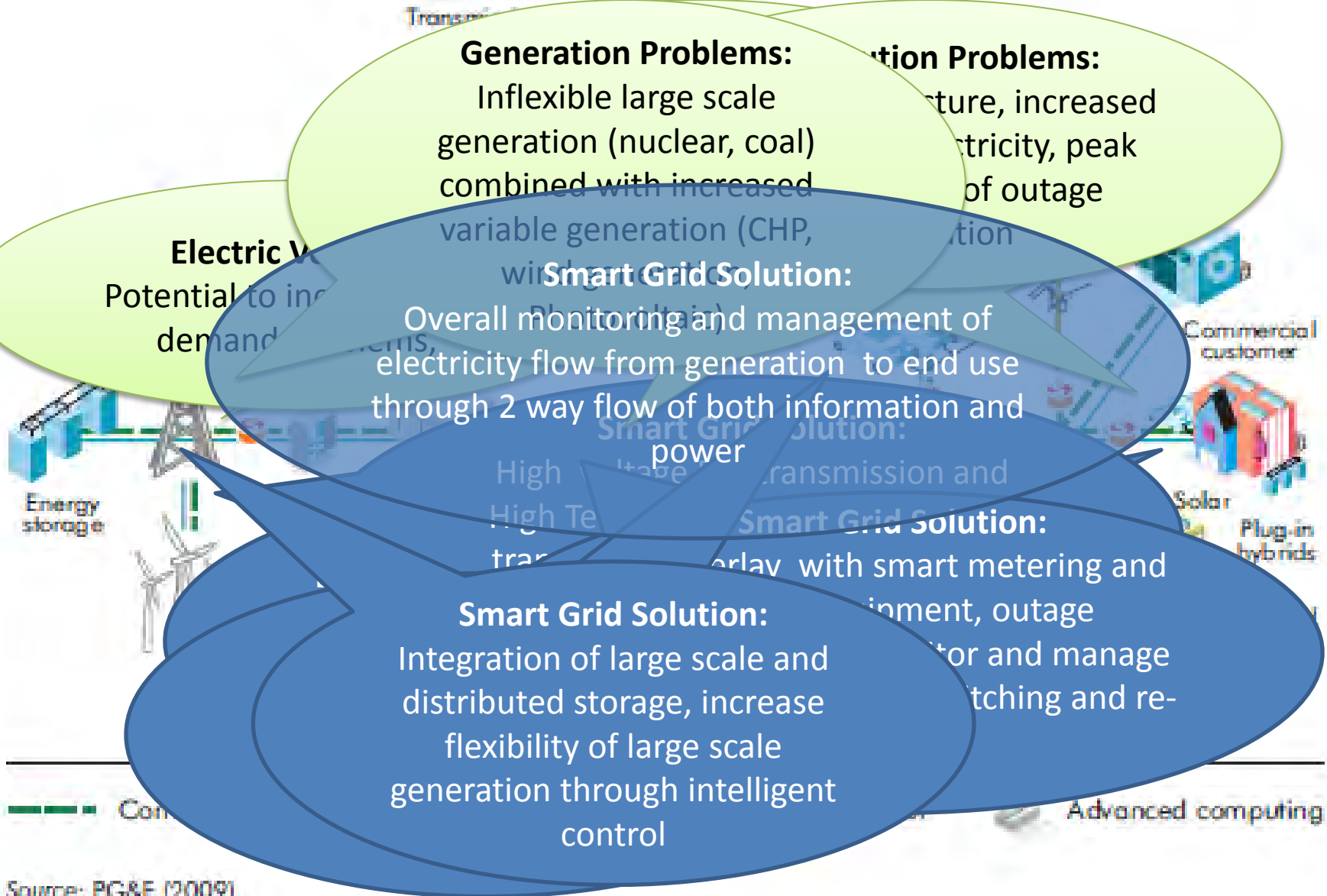


Low-carbon energy technology roadmaps

# Why are we here today to talk about Smart Grids?

- The term “Smart Grid” has provided a focus on the electricity system needs – policy makers are listening
- It is a misunderstood concept
- It can provide or enable solutions to many problems:
  - Increased electricity production from varRE
  - Peak demand reduction/ EV demand
  - Direct and indirect CO<sub>2</sub> emission reductions
  - Access to electricity (3 billion people)
  - Aging infrastructure





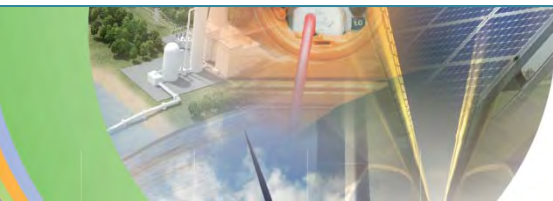
# Smart Grids introduce vast new functionality to the power sector

Current State
Analogue/electromechanical
Centralized (generators)
Reactive (prone to failures and blackouts)
Manual (field restoration)
One price
No/limited consumer choice
One-way communication (if any)
Few sensors
Manual restoration
Limited transparency with customers and regulators
Limited control over power flows
Estimated reliability



Modern Utility
Digital/microprocessor
Decentralized (generation)
<b>Proactive</b>
Semi-automated, automated (self-healing)
Real time pricing
Multiple consumer products
Two-way/integrated communication
Ubiquitous monitors, sensors
Condition-/performance-based maintenance
Transparency with customers and regulators
Pervasive control systems
Predictive reliability

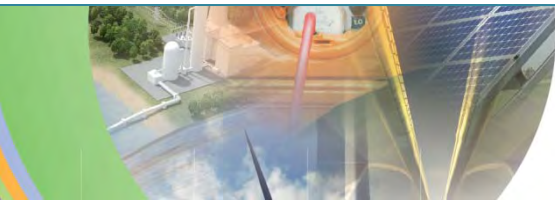
Source: Accelerating Smart Grid Investments, World Economic Forum 2009



# Smart Grid Benefits

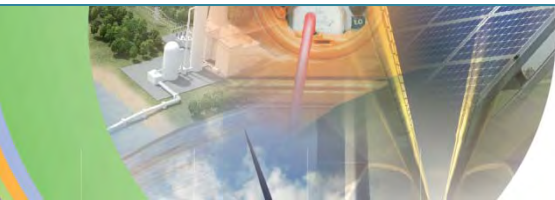
- Smart grids will offer the capability:
  - To reduce peak demand by actively managing consumer demand
  - To balance consumer reliability and power quality needs
  - To encourage the proactive application of energy efficiency opportunities
  - To improve overall operational efficiency
  - To integrate clean energy technologies

Adapted from <http://www.gridwise.org/>



---

# WHY DO WE NEED THE SMART GRID?

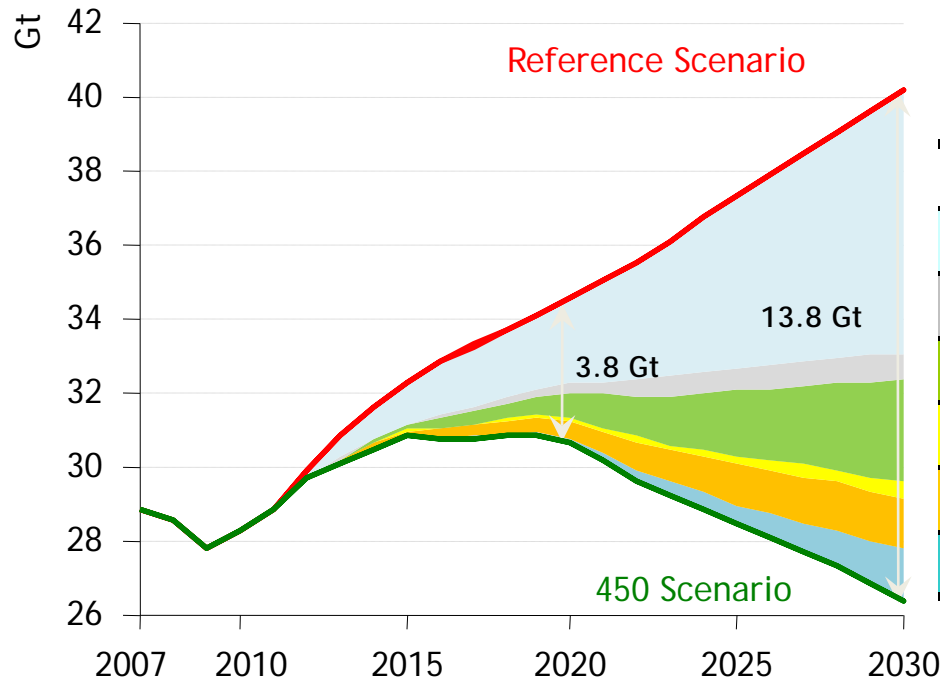


Low-carbon energy technology roadmaps





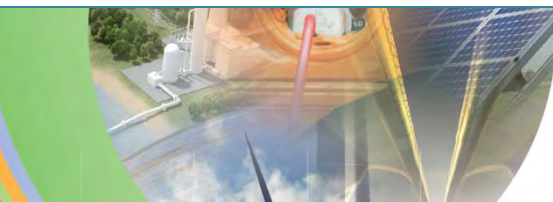
# World abatement of energy-related CO<sub>2</sub> emissions in the 450 Scenario



	Share of abatement %	
	2020	2030
Efficiency	65	57
End-use	59	52
Power plants	6	5
Renewables	18	20
Biofuels	1	3
Nuclear	13	10
CCS	3	10

Source: WEO 2009

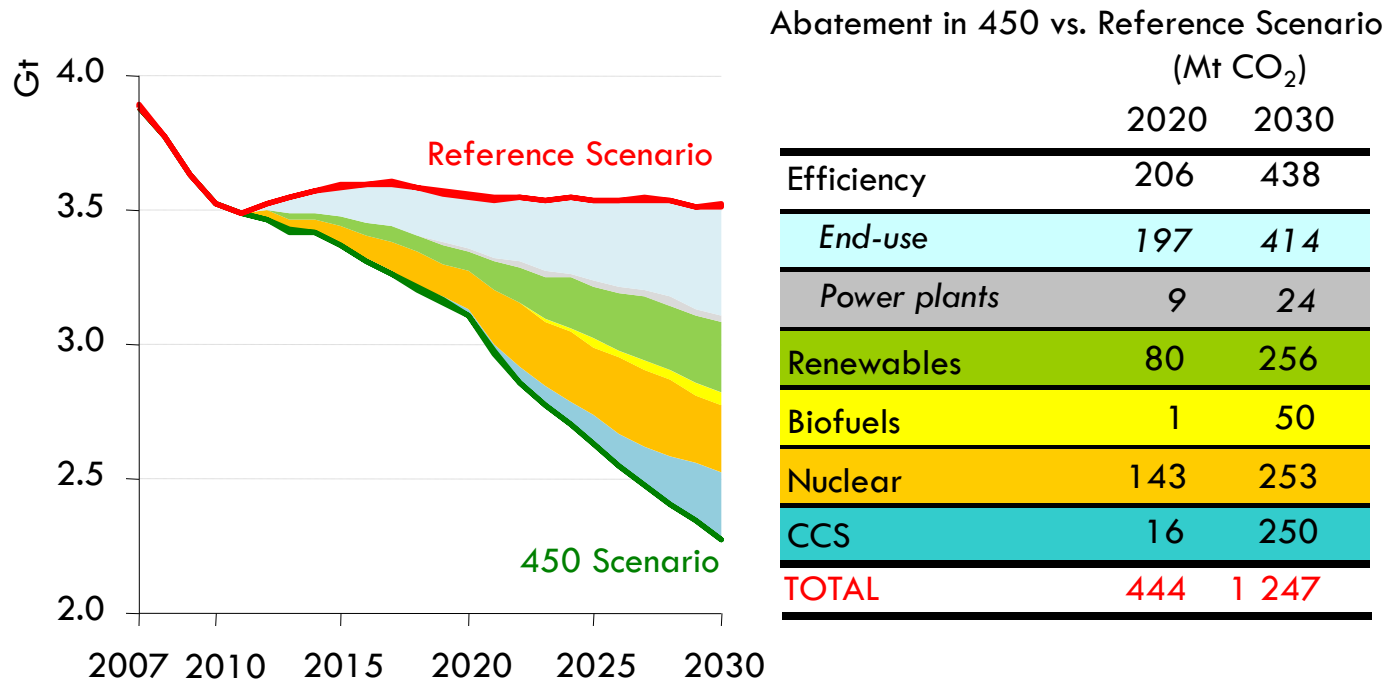
***In the 450 Scenario, renewable energy is the second largest contributor to CO<sub>2</sub> emissions abatement after energy efficiency***



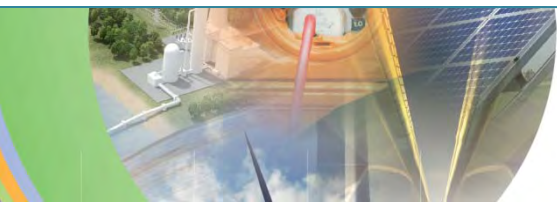
Low-carbon energy technology roadmaps



# European Union energy-related CO<sub>2</sub> emissions abatement



- **Total additional investment in the 450 Scenario of nearly \$1 300 billion in low-carbon power generation over 2010-2030 (77% renewables, 16% nuclear, 7% CCS)**



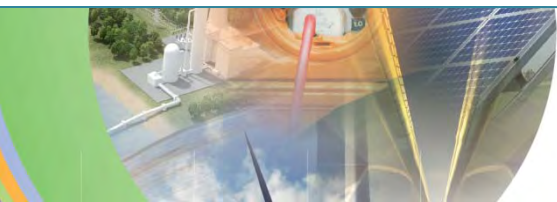
Low-carbon energy technology roadmaps

# Electricity Demand and Generation

## – ETP 2010

	Direct Use in Plant	T&D Losses	Pumped Storage	Total
OECD North America	4%	7%	1%	12%
OECD Europe	5%	7%	1%	13%
OECD Pacific	4%	5%	1%	10%
Economies in transition	7%	12%	0%	20%
China	8%	7%	0%	15%
India	7%	26%	0%	33%
Other Asia	4%	9%	0%	13%
Latin America	3%	17%	0%	20%
Africa	5%	11%	1%	17%
Middle East	5%	13%	0%	18%
World	5%	9%	1%	15%

TRILLIONS OF \$/¥/£/ € ETC. WILL BE INVESTED

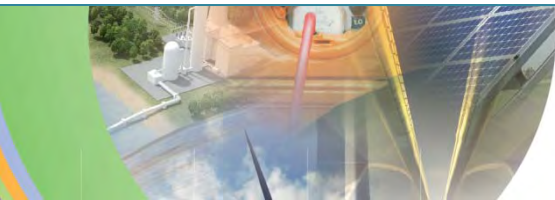


Low-carbon energy technology roadmaps



---

# HOW DO WE GET THERE FROM HERE?



Low-carbon energy technology roadmaps



# Smart Grid Roadmap

## Scope:

*Demonstrate future electricity system needs and solutions provided through the development and deployment of the Smart Grid in electricity generation, transmission, distribution and end-use sectors.*

## Workshops:

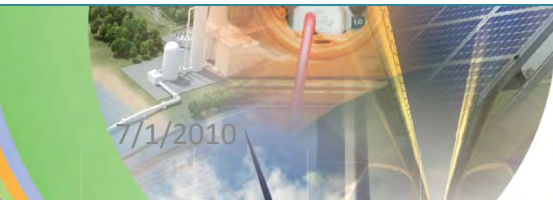
- Smart Grid technology RD&D needs (May 2010)
- Roles of Government and Private Sector in Smart Grid RD&D (June 2010)
- Regional assessment of Technology, Policy and Regulation (Sept 2010)

## Targeted Analysis:

- Estimated cost of the Smart Grid
- CO<sub>2</sub> Emission reductions due to Smart Grid deployment

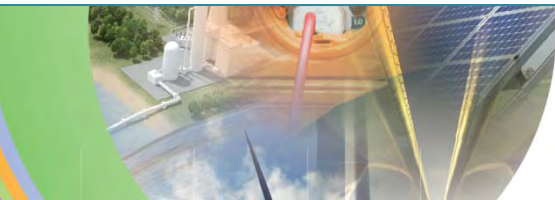
## Release Date

Late 2010 / Early 2011



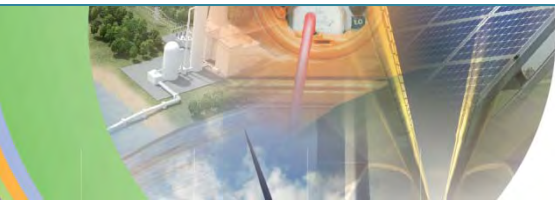
# Preview to some Smart Grid Roadmap Findings

- Although it will include new technology and new build, the integration of existing electricity infrastructure is very important
- The “Smartening” of grids is already happening – it is not a one time event
- Different parts of the grid already have certain amounts of intelligence
- Government and the private sector are going to need to work together to deliver the Smart Grid.



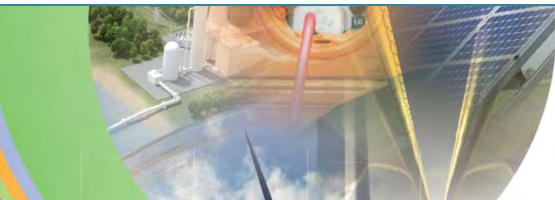
# Some Key Questions for Smart Grid Deployment

- How do you support technology that needs to be demonstrated in a systems setting?
- How do you encourage conservative industries/combined with aggressive new entrants?
- How do you evaluate the impact of business models/regulation into the development of demonstration schemes?
- How do you innovate in a sector that requires very high levels of reliability?
- How do you develop policies that are less tied to basic market scenarios, but rather common good?
- Who benefits? Who Pays?



# Conclusions

- Determine your regional needs – prioritize what you need to do
  - Existing infrastructure
  - Electricity demand and generation future
  - Collaborate with other regions who have similar needs/capabilities
- Market and regulatory considerations are very significant
- Understand your stakeholders:
  - Policy makers – are they non-experts?
  - Regulators – what are their objectives/problems
  - Customers – what to they want and need?
- Smart Grids are coming – its going to be cool!!!



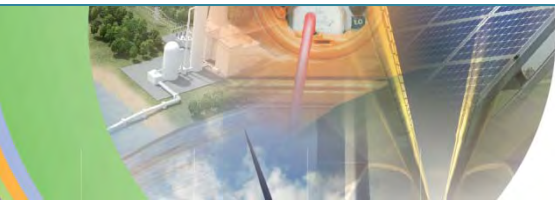


# Thank you

[www.iea.org/techno/etp/index.asp](http://www.iea.org/techno/etp/index.asp)

[www.iea.org/roadmaps](http://www.iea.org/roadmaps)

[david.elzinga@iea.org](mailto:david.elzinga@iea.org)



Low-carbon energy technology roadmaps



© OECD/IEA 2009