



INSTITUTO DE INVESTIGACIÓN TECNOLÓGICA - IIT

Active Demand and the Role of Consumers in Future Power Systems

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What is Active Demand (Demand Response)?

- Normal Demand in other markets: Consumers respond to variable prices
 - And in the process make them efficient
- But this could not be done in the power sector:
 - Prices vary hourly (or more)
 - Technology was not there to measure changes

Welcome smart meters (and smart grids)

- Now we can measure
- And consumers can respond
- 16% increase in DR between 2009 and 2010, 10.5% of peak demand in PJM
- But this has a cost





Types of response

- Load shifting
- Load conservation (largest part)

Classification criteria	Dualities	
Purpose	Reliability	Economics
Trigger factor	Emergency-based	Price-based
Origin of signal	System-led	Market-led
Type of signal	Load response	Price response
Motivation method	Incentive-based	Time-based rates
Control	Direct load control	Passive load control



Benefits from Active Demand programs

- Generation
 - Reduced fuel costs, emissions (?)
 - Reduced/Delayed investments
 - Better balance – Reduced reserves
 - Increased penetration of RES
- Transmission & Distribution
 - Relieve congestion, outages
 - Manage contingencies, better operation
 - Reduced/Delayed investments
- Other
 - Reduced market power
 - Less volatility
 - Better consumer awareness

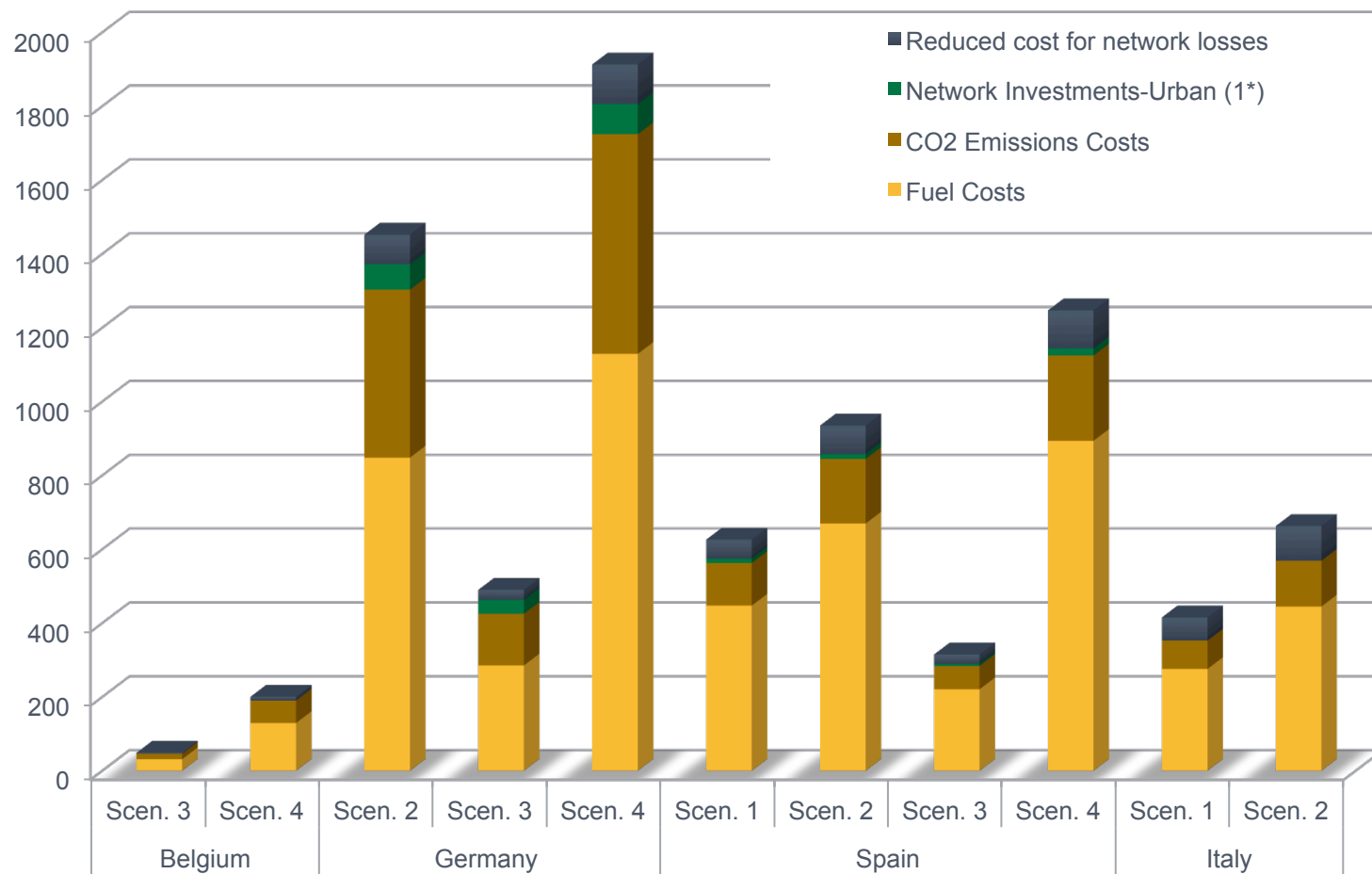
Some preliminary numbers - Spain

NPV (9%, 10years)	Costs in BS	Savings with respect to BS					
[M€]	DR-0%	DR-25%		DR-50%		DR-100%	
Investment cost	12,327	0	0.0%	0	0.0%	0	0.0%
Fuel cost	41,330	232	0.6%	464	1.1%	926	2.2%
CO ₂ allowances	8,939	39	0.4%	77	0.9%	155	1.7%
TOTAL	62,596	270	0.4%	541	0.9%	1,081	1.7%

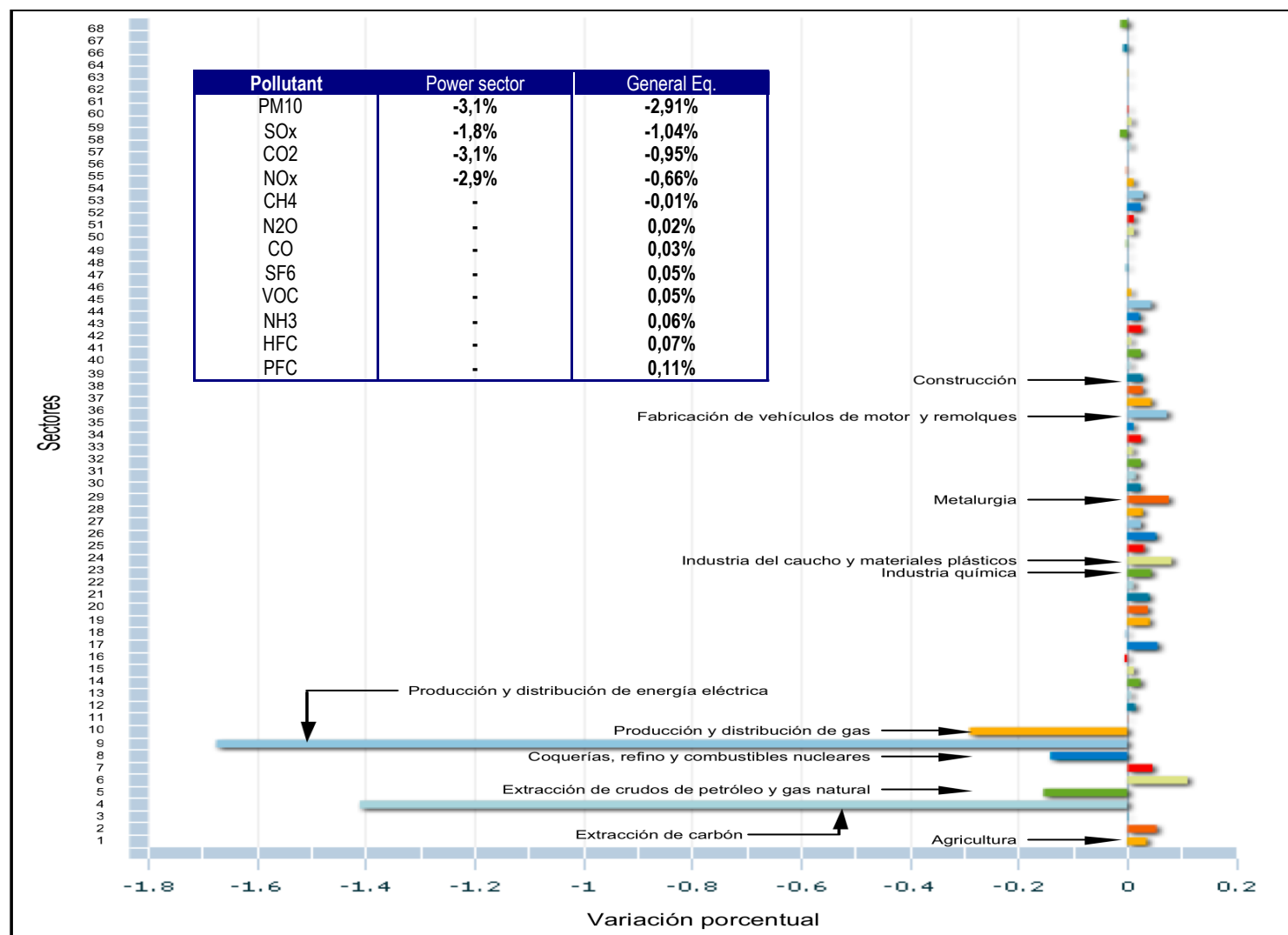
The model considers feedback effects within the power sector

NPV (9%, 10years) [000 €]	Cost in BS	Savings with respect to BS					
	DR-0%	DR-25%		DR-50%		DR-100%	
Investment costs	72,979	204	0.3%	506	0.7%	1,082	1.5%
Maintenance costs	14,916	39	0.3%	135	0.9%	327	2.2%
TOTAL	87,894	243	0.3%	641	0.7%	1,409	1.6%

Some preliminary numbers - Europe



But there may be a rebound





The cost-benefit analysis is not clear

- Depends on the business model
 - Degree of automation
- On the evolution of technology
 - Cost of the smart grid
- On the prices of electricity
 - Increasing? Or not?
- And on the response of consumers

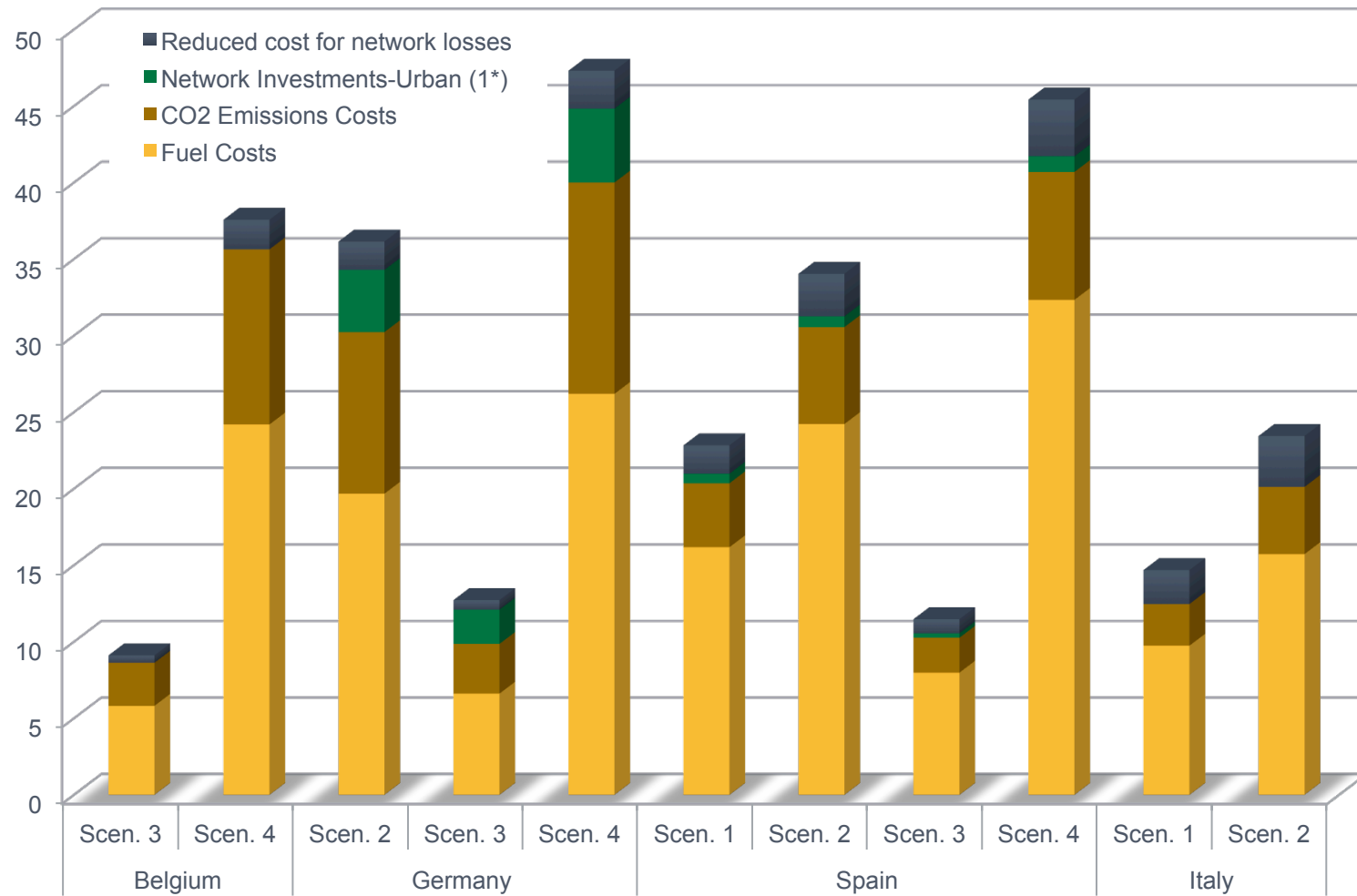




How will consumers respond?

- Studies have shown that there is some elasticity
 - 10-15% reductions in peak loads
 - Similar reductions in energy demand
- This depends on how signals are sent
 - CPP better than TOU, TOU better than RTP
 - Technology doubles the response
- And on the equipment / consumption
 - Low-income consumers are more responsive
 - Higher-volume consumers are more responsive

But we may need an extra push





And some regulatory intervention

- Sharing costs and benefits
- Potentially large redistribution issues
 - From flat rate to RTP
 - From producers to consumers
- Regulated activities
 - Contracting issues
 - Remuneration issues
- Standardisation
- Verification - Measurement



What if we just provide feedback?

- Low cost, low response
 - OPOWER (comparison with peers)
 - 2% reduction
 - Half is lost between invoices (Bounded attention)
 - Higher-income saves more than lower-income
 - GOOGLE (Self-reference)
 - 6% reduction
 - Only lasts 4 weeks
 - Mostly change in habits



The future business model

- Relationship with customers
 - Automated: effective, expensive
 - Non-automated: cheap, law of big numbers
- Revenue neutrality
- The issue of trust
 - Aggregators are better viewed than retailers / utilities
- Niche application: consumer profiling
- The utility of the future



A final (precautionary) note

- Consumers must step in themselves
 - Not considered as consumers, but as customers
 - Backlash against smart metering
 - Particularly when they end up paying more
 - Or when this is seen as a DSO request paid for by consumers
- Existing companies will lose out

Thanks!

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