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Towards smarter distribution grids: drivers, experiences and regulation

Regional Workshop on Smart Grid Deployment in the Danube Region
Brussels, 18th November 2013

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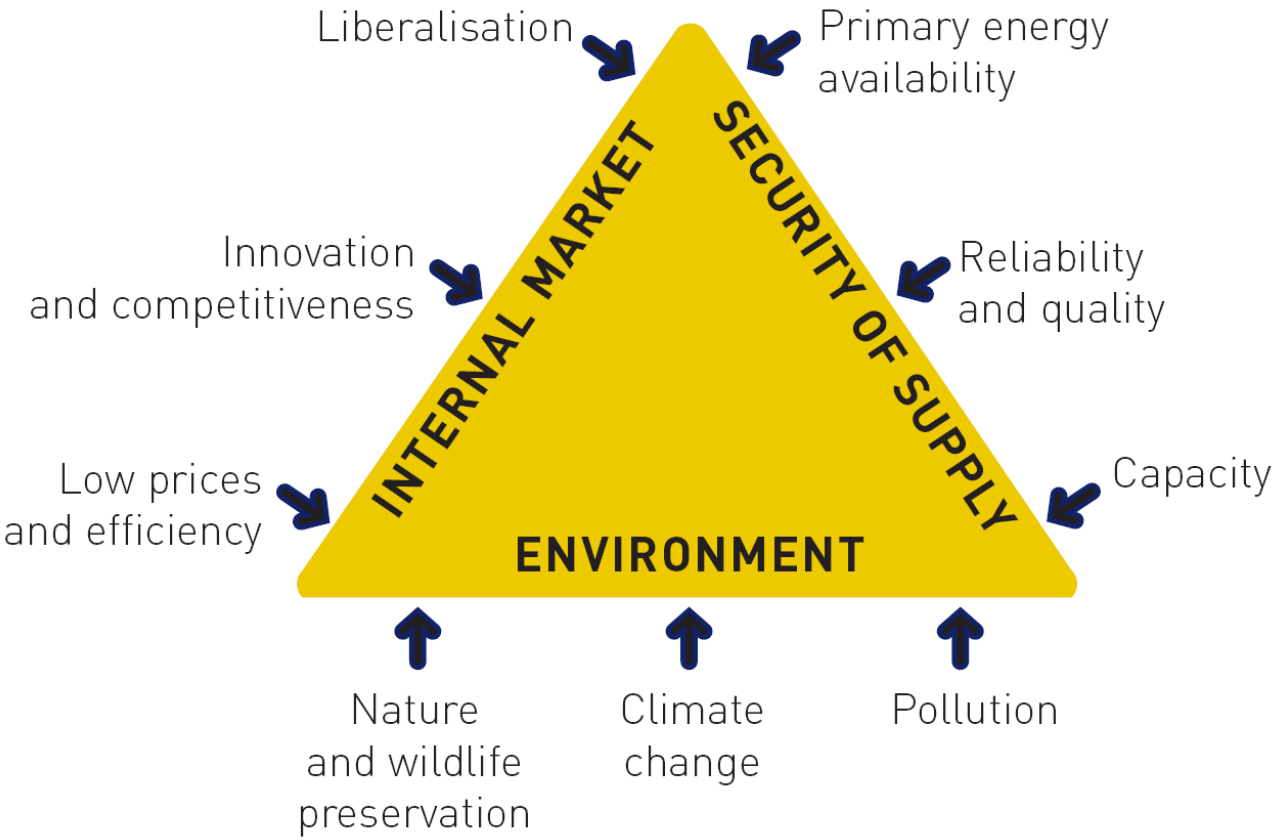
Drivers

- Energy policy: top-down approach



Source: ETP-Smartgrids

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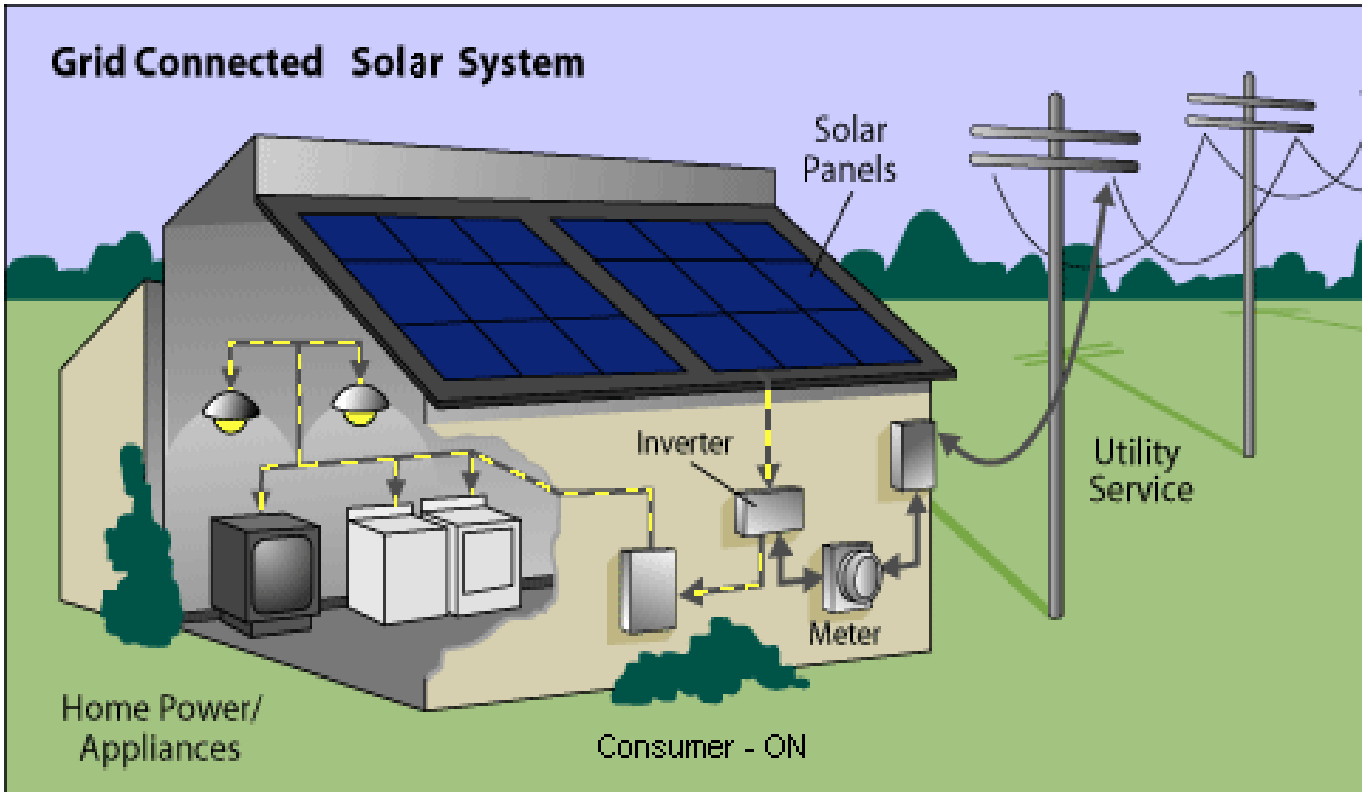
Drivers

- Changing consumers' attitude: bottom-up approach



http://www.greenbrilliance.com

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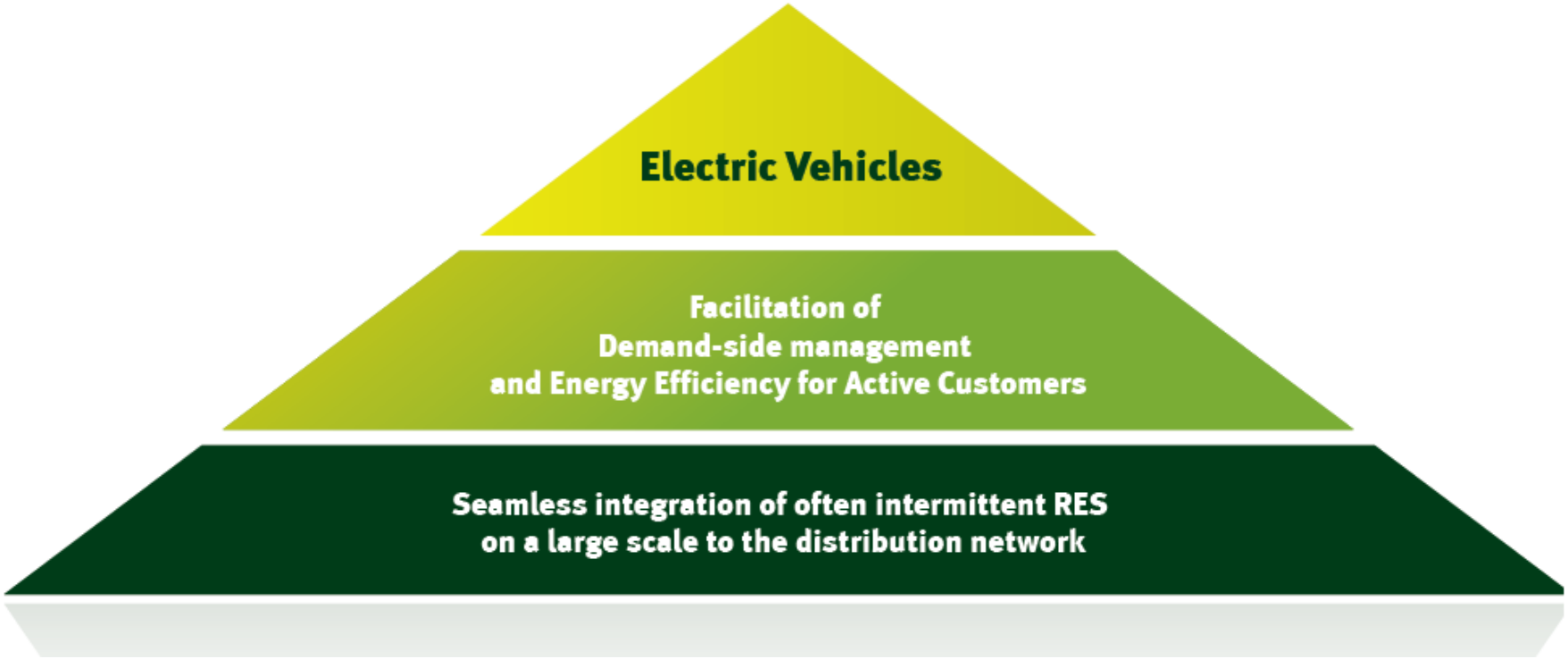
Drivers

- Smarter distribution grids are deemed necessary to **integrate** growing levels of DER **efficiently**



Source: Eurelectric

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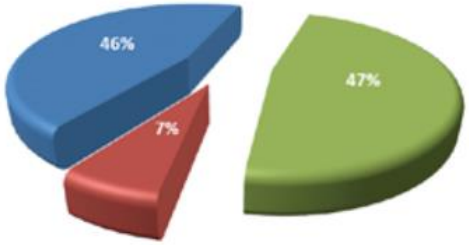
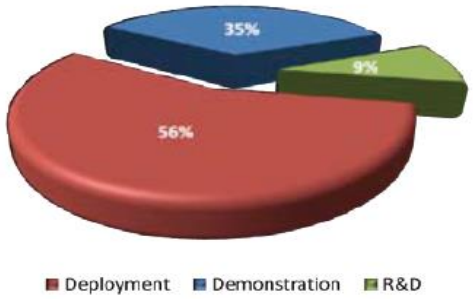
Experiences

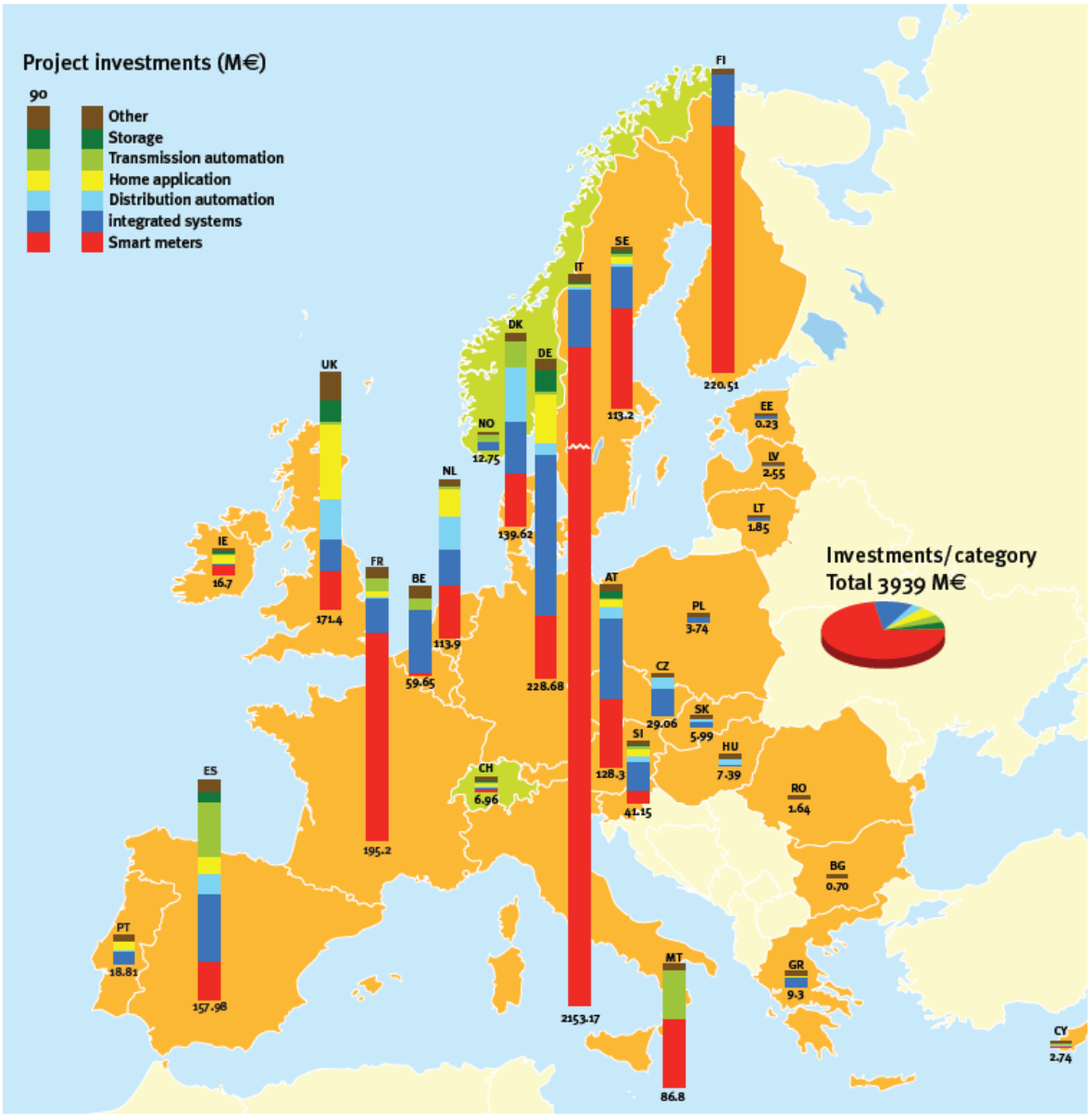


Number of projects



Expenditures

Source: JRC



Experiences

- Significant investments already committed
- More required in the future for the EU

Forecast Smart Grid investments (€/$)	Funding for Smart Grid development (€/$)
€56 billion by 2020 [47]* *(estimated Smart Grid investments)*	€184 million (FP6 and FP7 European funding for projects in the JRC catalogue) About €200 million from European Recovery Fund, ERDF, EERA. National funding: n/a

Expenditures by 2020
Source: JRC

Cluster	Title	R&I Investment in million €
	TSO part	
C1	Grid architecture	70
C2	Power technologies	350
C3	Network operation	125
C4	Market designs	75
C5	Asset management	135
Sub total		*755*
	Joint TSO/DSO	
	Joint TSO/DSO R&I activities	*250*
	DSO part	
C1	Integration of smart customers	240
C2	Integration of DER and new users	330
C3	Network operations	400
C4	Network planning and asset management	100
C5	Market design	20
Sub total		*1090*
Total		2095

Expenditures by 2022
Source: EEGI

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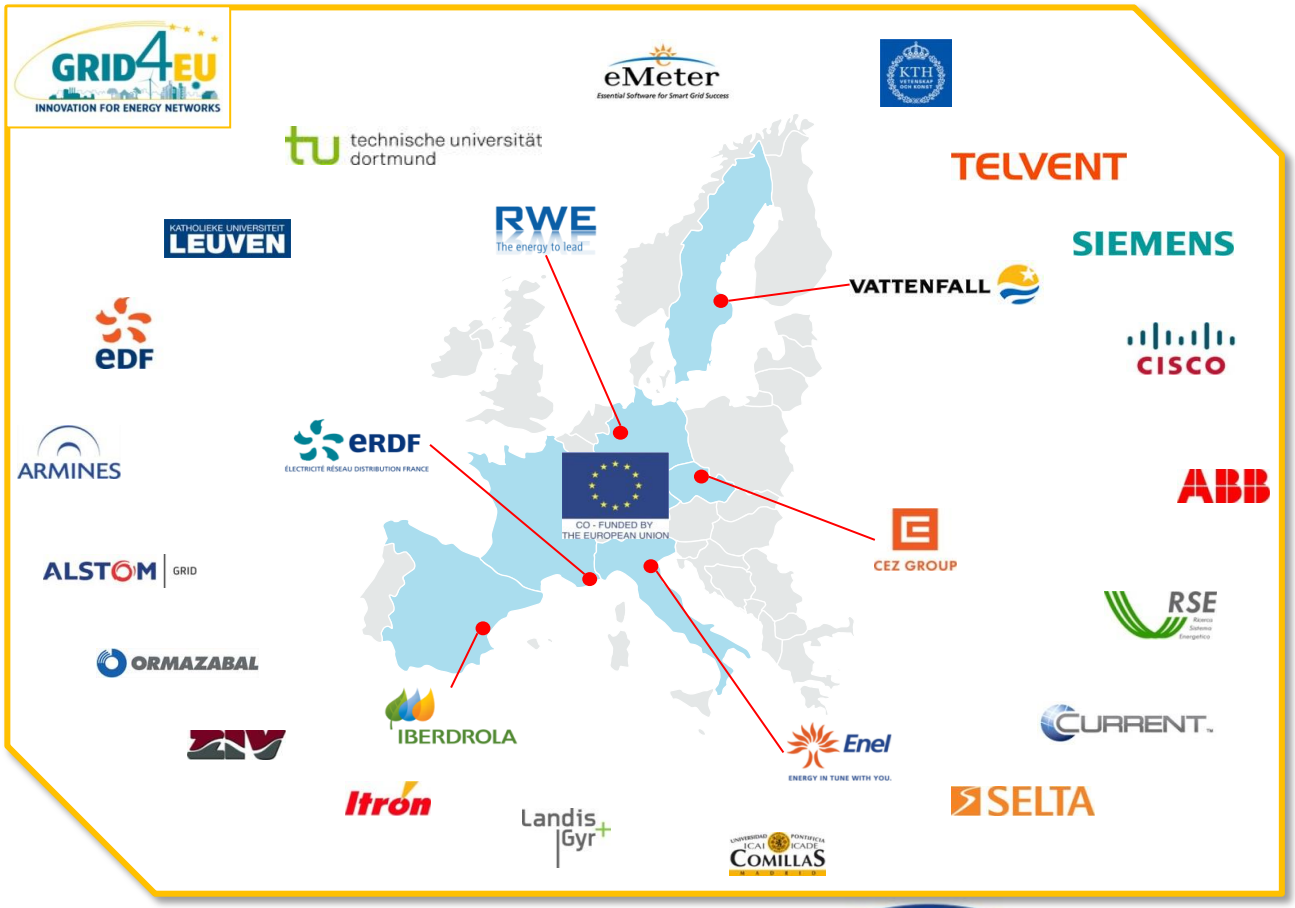
Experiences

GRID4EU Project

- 4-year FP7 project started in Nov.2011
- 27 partners from several EU member states
- 6 DSOs represent more than 50% of the total European customers base



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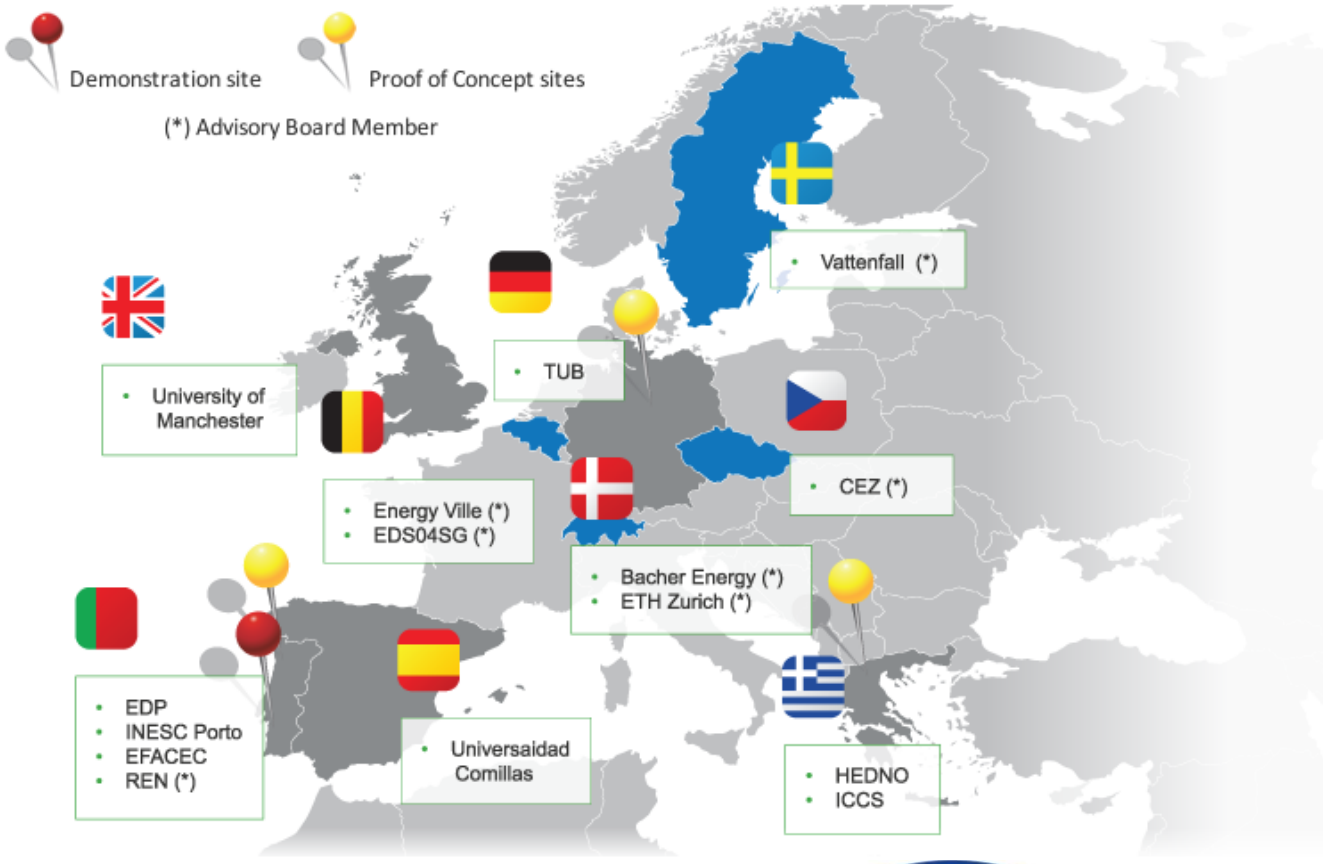
Experiences

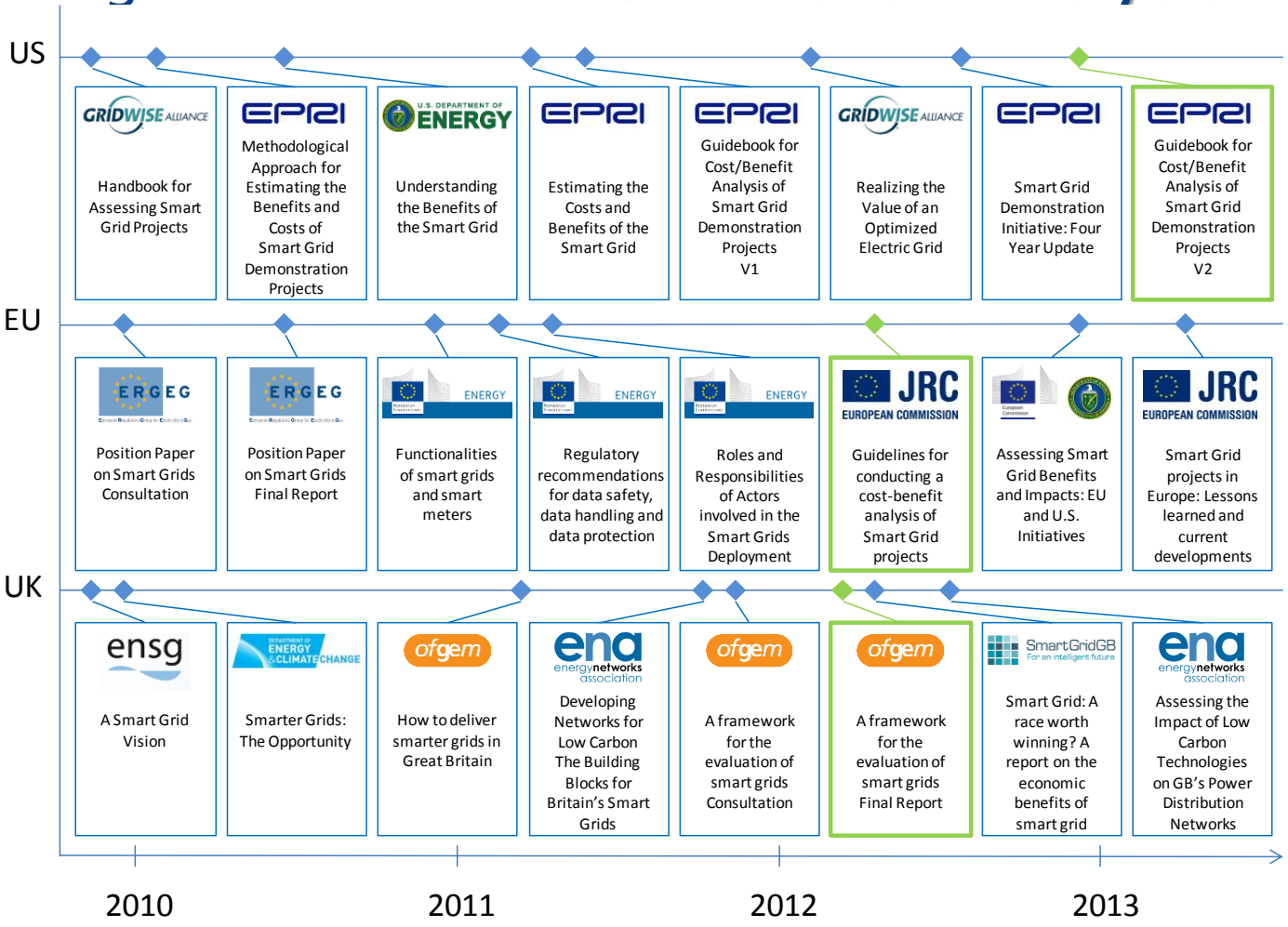
SuSTAINABLE Project

- 3-year FP7 project started in Jan.2013
- 8 partners from 5 EU member states
- 1 Demonstration InovGrid in Évora
- 3 laboratory validations



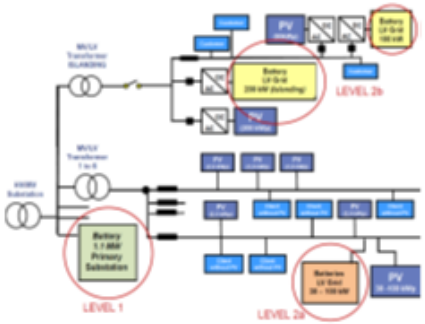
Experiences

- Leverage on results? → **Cost-Benefit Analysis**



Experiences

- Leverage on results? → **Scalability & Replicability**



Demo site

Scalability

Large-Scale deployment

Replicability

Reproduce functionalities

Regulation

"The current regulatory framework does not sufficiently encourage investments in distribution grids. Any business-as-usual approach will thus not lead us into the future."
Eurelectric (2011) – Regulation for smart grids

"Regulating Innovation and Innovating Regulation"
DG-GRID Project – Deliverable 5

"Smart regulation for smart grids"
EUI Working Paper RSCAS 2010/45, Florence School of Regulation

"Innovating grid regulation to regulate grid innovation"
Meeus & Saguan (2011)

"Changing the regulation for regulating the change"
Lo Schiavo et al. (2013)

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Regulation: DSO as market facilitator

- Deployment of smart meters
  - Ownership and management
  - Deployment: liberalized vs. regulated model
- Data handling
  - DSO vs. Regulated entity vs. Independent manager

Ownership/management of metering equipment

UK vs. DE vs. IT

Data handling

DSO vs. Central Data Hub vs. Data Access-Point Manager

Smart Grid Task Force EG3 (2013)

Source: THINK Project

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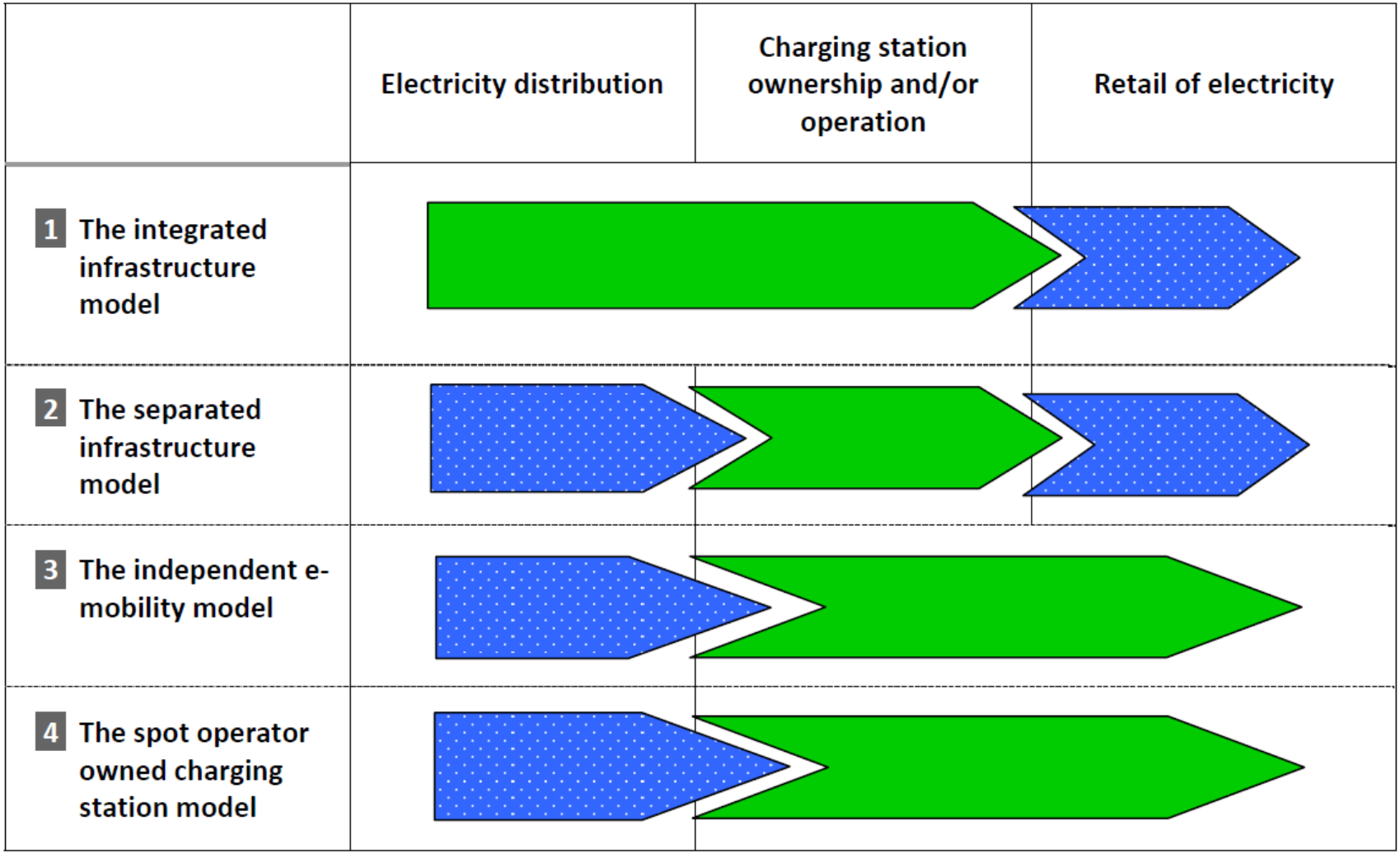
Regulation: DSO & EV charging infrastructure



Source: Eurelectric

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Regulation: interactions with other agents

Service	Type of DER able to offer the service	System operator procuring such services
System balancing services	All types of DER	TSO
Frequency control	All types of DER	TSO
Voltage control	All types of DER	DSO
Blackstart	Larger-scale DS and DG	TSO and DSO
Short-term security congestion management	DG, DS, DR, (EV)	TSO and DSO

Source: THINK Project

- DER provision of AASS:
  - From network supervision to system operation
  - Regulatory mechanisms required: distribution grid codes, local markets, incentive schemes, etc.
- Middleman in AASS provision of DER to TSO:
  - Verify service provision
  - Technical validation

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Regulation: DSO remuneration

- Short-term: compensate DSOs for **incremental costs**
- Several alternatives:
  - Partial cost **pass-through**:

$$TAR_t = TAR_{t-1}(1 - X) + y\% \cdot I_t^{DG}$$

  - DER-related **revenue drivers**:

$$TAR_t = TAR_{t-1}(1 - X) + F_1 \cdot kW^{DG} + F_2 \cdot MWh^{DG}$$

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Regulation: DSO remuneration

- Long-term: efficient DER integration
- Integrated cost assessments:
  - Adding DER variables in frontier models (SFA, DEA)
  - Second stage regressions
  - Use of reference network models
- Innovative remuneration schemes:
  - Menus of contracts
  - Increased focus on outputs

Ratio DSO/Regulator	95	100	105	110	115	120	125	130	135	140
Allowed revenues	98.75	100	101.25	102.5	103.75	105	106.25	107.5	108.75	110
Sharing factor	63.8%	60.0%	56.3%	52.5%	48.8%	45.0%	41.3%	37.5%	33.8%	30.0%
Additional income	3.7	3.0	2.2	1.3	0.3	-0.8	-1.9	-3.2	-4.5	-6.0
85	12.5	12.0	11.3	10.5	9.5	8.3	6.8	5.3	3.5	1.5
90	9.3	9.0	8.5	7.9	7.0	6.0	4.8	3.4	1.8	0.0
95	6.1	6.0	5.7	5.3	4.6	3.8	2.7	1.5	0.1	-1.5
100	2.9	3.0	2.9	2.6	2.2	1.5	0.7	-0.4	-1.6	-3.0
105	-0.3	0.0	0.1	0.0	-0.3	-0.8	-1.4	-2.3	-3.3	-4.5
110	-3.5	-3.0	-2.7	-2.6	-2.7	-3.0	-3.5	-4.1	-5.0	-6.0
115	-6.7	-6.0	-5.5	-5.3	-5.2	-5.3	-5.5	-6.0	-6.7	-7.5
120	-9.8	-9.0	-8.3	-7.9	-7.6	-7.5	-7.6	-7.9	-8.3	-9.0
125	-13.0	-12.0	-11.2	-10.5	-10.0	-9.8	-9.7	-9.8	-10.0	-10.5
130	-16.2	-15.0	-14.0	-13.1	-12.5	-12.0	-11.7	-11.6	-11.7	-12.0
135	-19.4	-18.0	-16.8	-15.8	-14.9	-14.3	-13.8	-13.5	-13.4	-13.5
140	-22.6	-21.0	-19.6	-18.4	-17.3	-16.5	-15.8	-15.4	-15.1	-15.0

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Regulation: DSO innovation

- Adapt regulatory designs:
  - Longer regulatory periods: uncertainty vs. efficiency
  - Rolling mechanisms
  - Equalize CAPEX-OPEX solutions
- Specific incentives to innovate (smarter grids):
  - **Input based**:
    - Subsidies (UK-LCNF, NIC, NIA)
    - Higher rate of return (Italy & Romania – extra WACC)
  - **Output based**:
    - Hosting capacity as revenue driver (Italy)
    - Future UK RIIO regulation

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Thank you for your attention!

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For more information, please visit:

http://www.grid4eu.eu/

http://www.sustainableproject.eu

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