EURELECTRIC
Innovation Action Plan

Utilities: Powerhouses of innovation

'An Innovation Action Plan for the European Electricity Sector'

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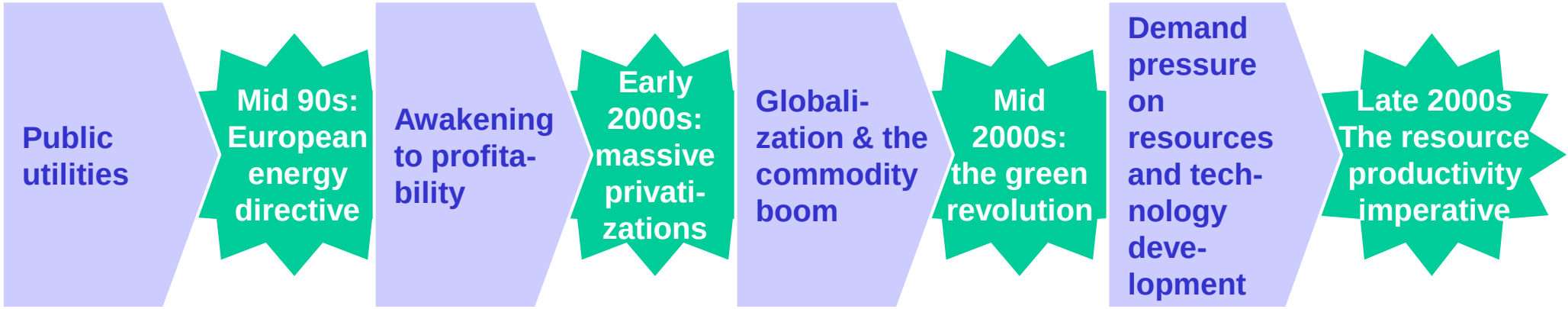
Paris, IEA
24 April 2014

The European energy sector has experienced profound change in the last decades



- National/local vertically integrated companies, government owned
- Full national-based regulation

- Unbundling of vertically integrated monopolies
- Beginning of competition in power generation at local level

- Consolidation at European level
- Full competition in generation and retail

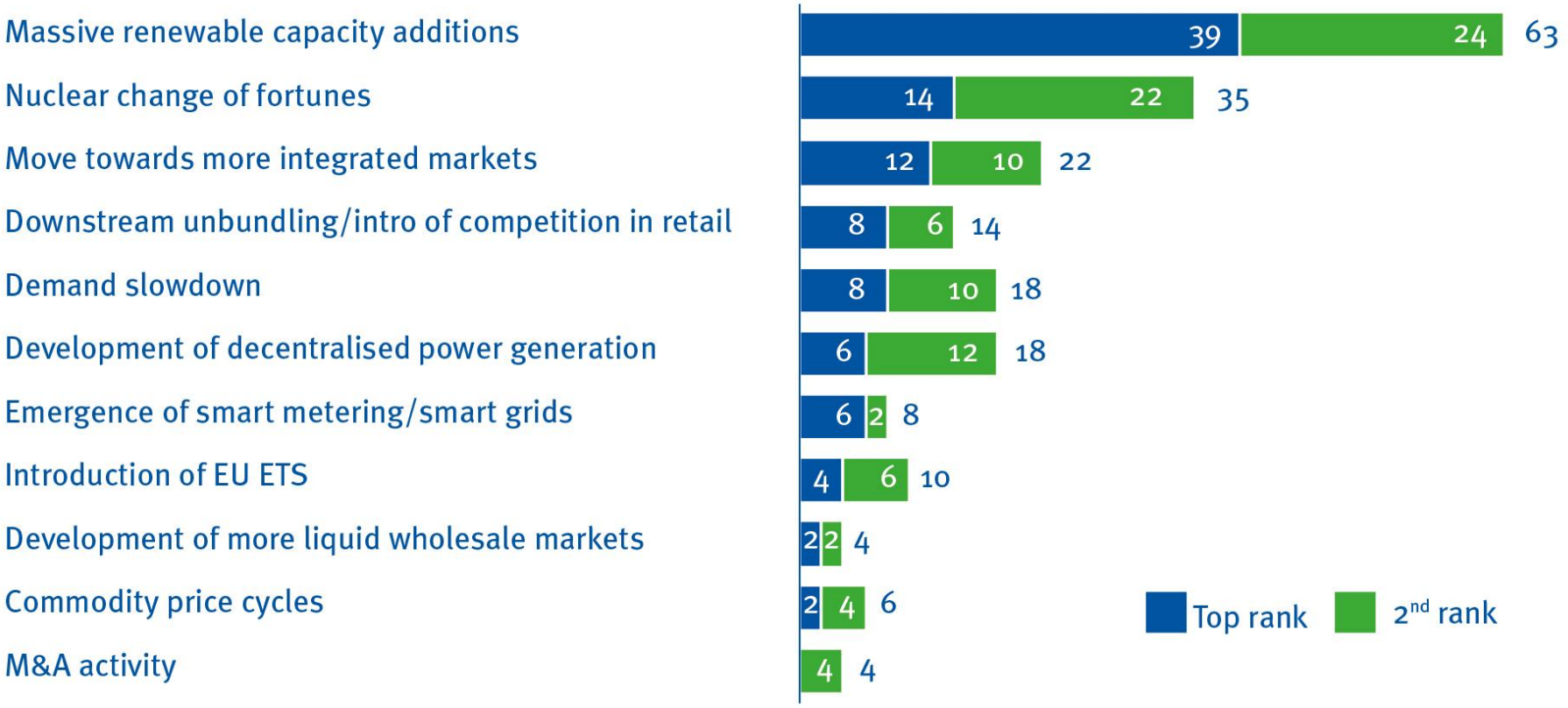
- Rush for “green” assets and RES investment bonanza
- Rise of producers - consumers

This change has given rise to some spectacular developments…

SOURCE: McKinsey & Company

Utility executives saw a range of powerful trends acting on the sector in the last decade, with new renewables the single most powerful influence

Utility executives ranking of trends impacting the power sector in the last decade
% of respondents

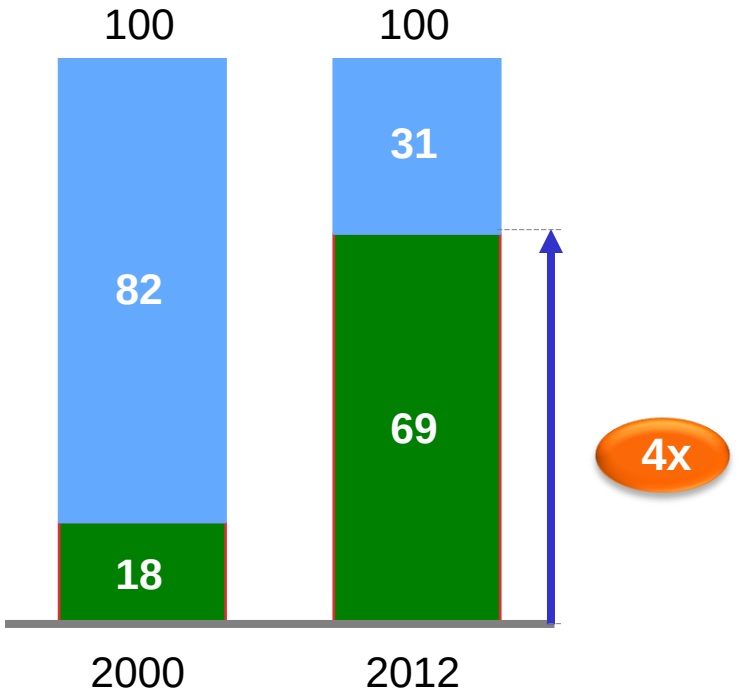


SOURCE: EURELECTRIC Innovation Action Plan survey, December 2012

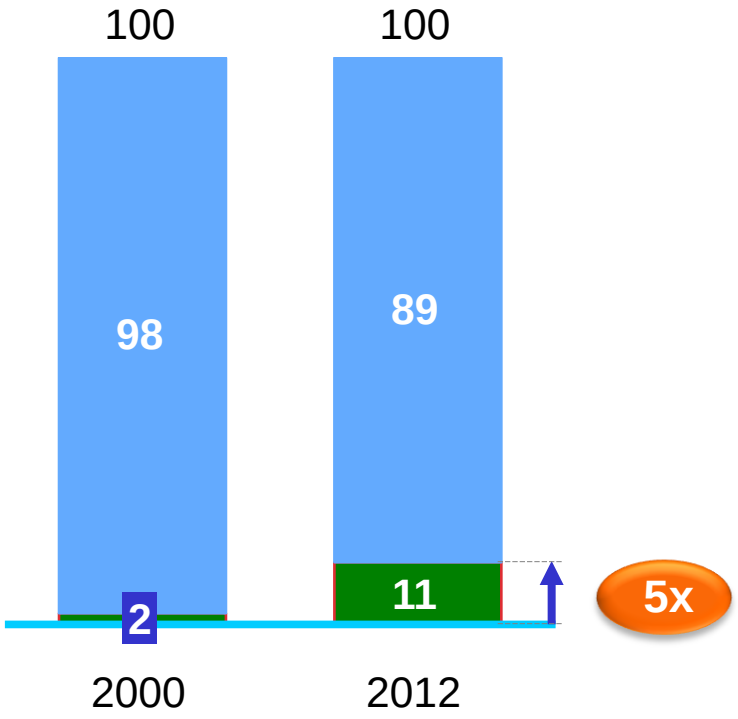
1 Renewables are now taking a large majority of investment

Conventional
Renewables

Share of new capacity additions in EU
Percent



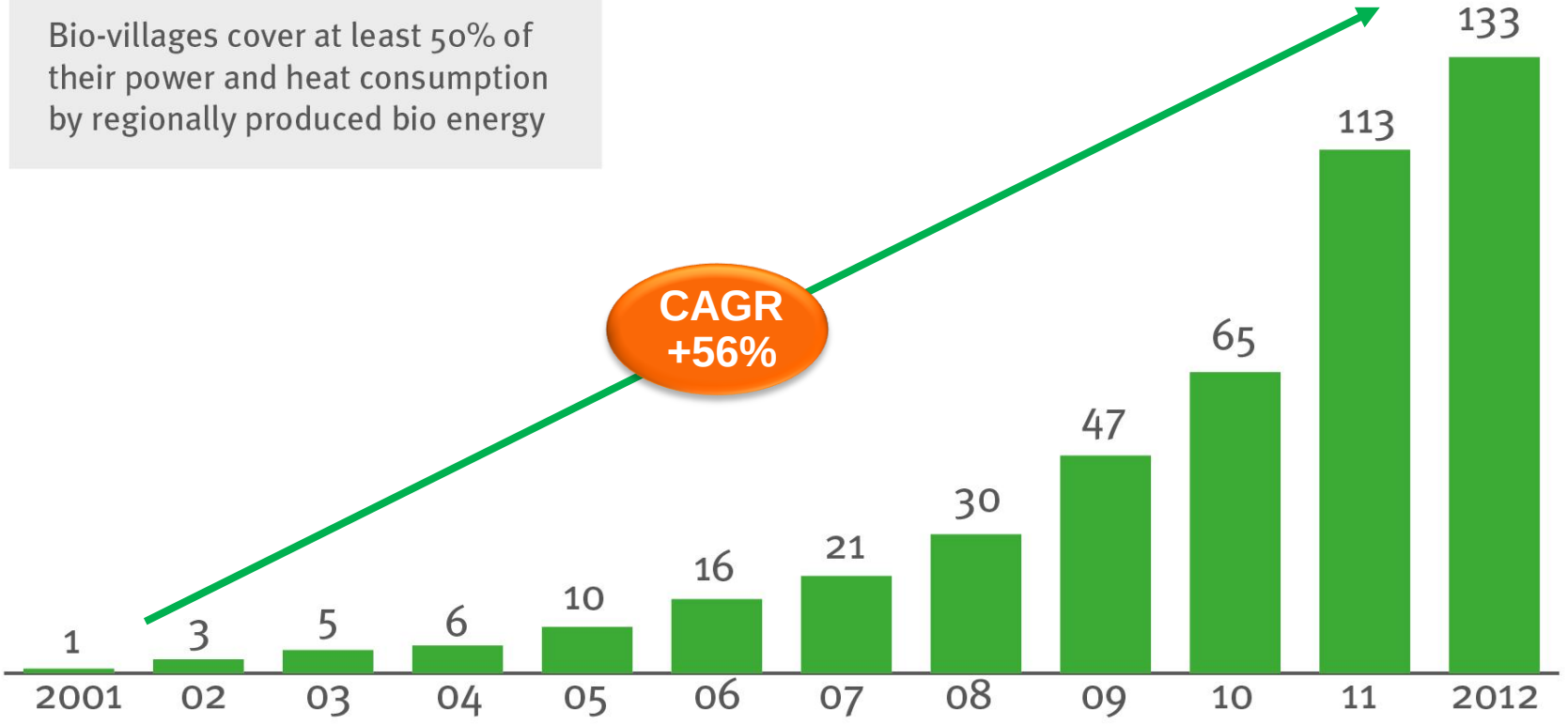
Share of generation mix in EU
Percent



2. Decentralised generation emerged and is on the rise

Number of bio-villages in Germany

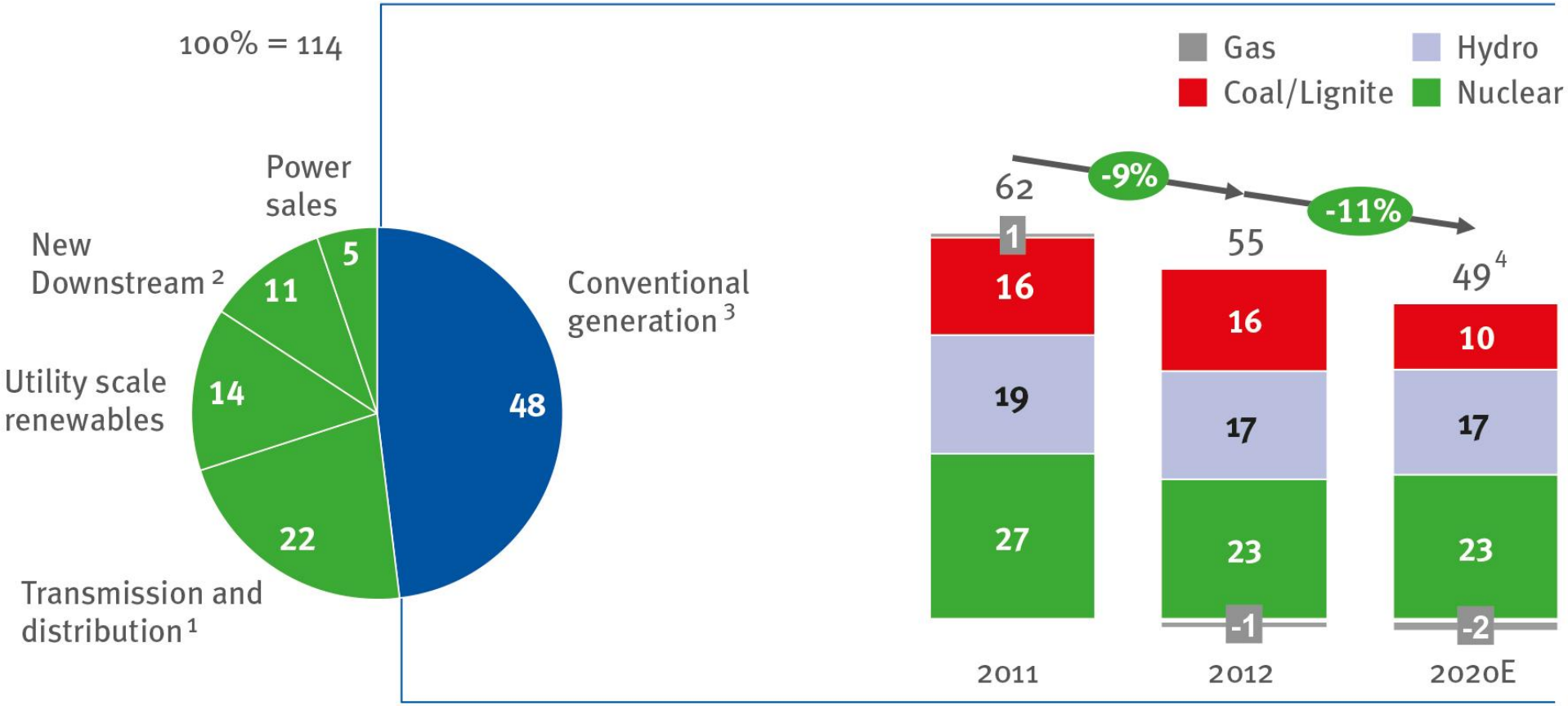
Bio-villages cover at least 50% of their power and heat consumption by regionally produced bio energy



SOURCE: Ministry of Food, Agriculture, and Consumer Protection, Agency for Renewable Resources, EURELECTRIC IAP Taskforce analysis

The value creation of conventional generation, the core profit pool of the industry, is declining

European EBIT pool, EUR billions, Percentage, 2012 real

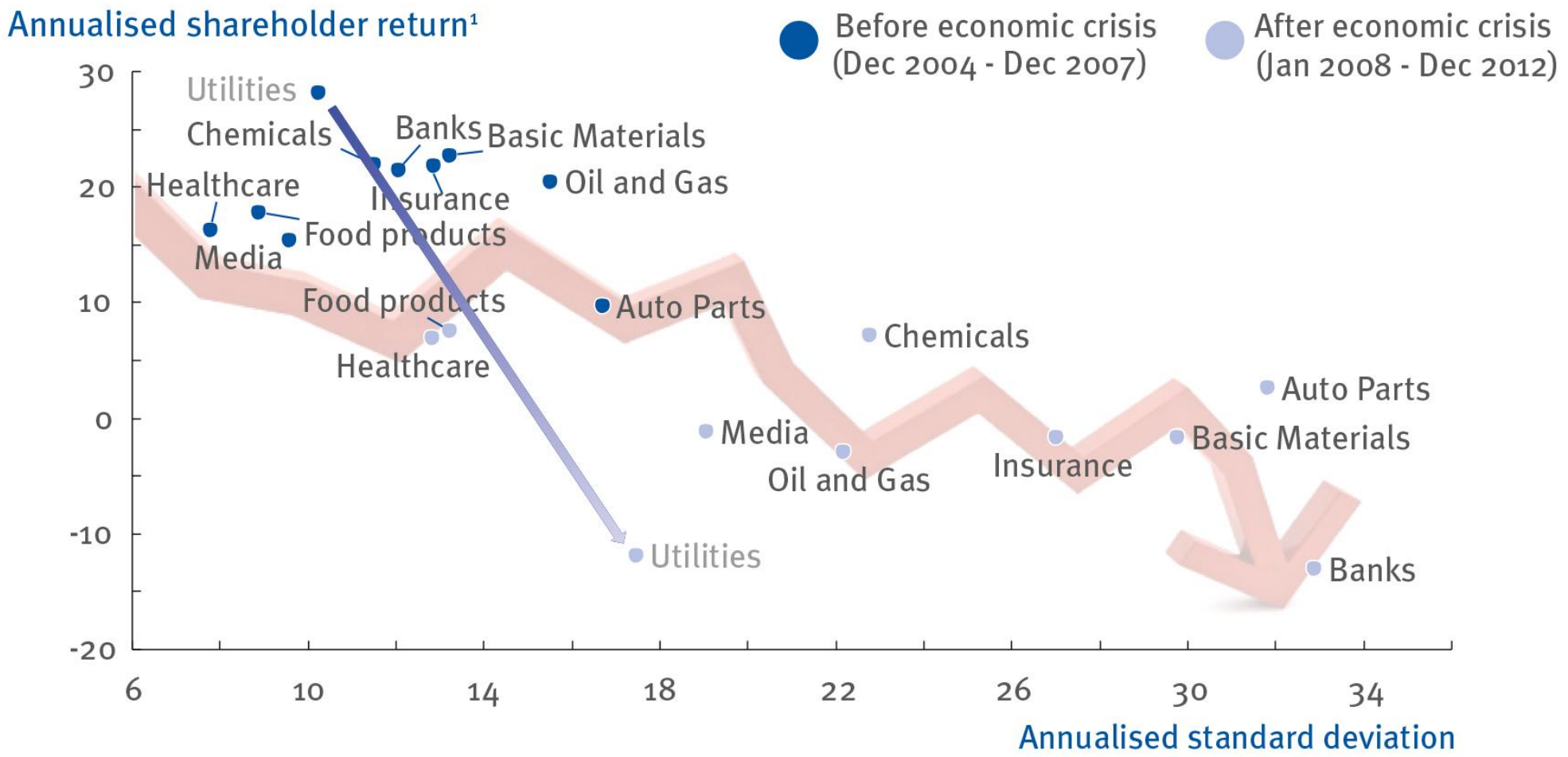


1 Includes transmission, conventional distribution, and smart grids
2 Includes distributed generation, EV infrastructure, new downstream products and services
3 Excludes earnings from ancillary services
4 Assuming no change in commodity prices vs. today

SOURCE: McKinsey Power Model, industry vision team analysis

European utilities' stock market performance has recently deteriorated…

Percent per year



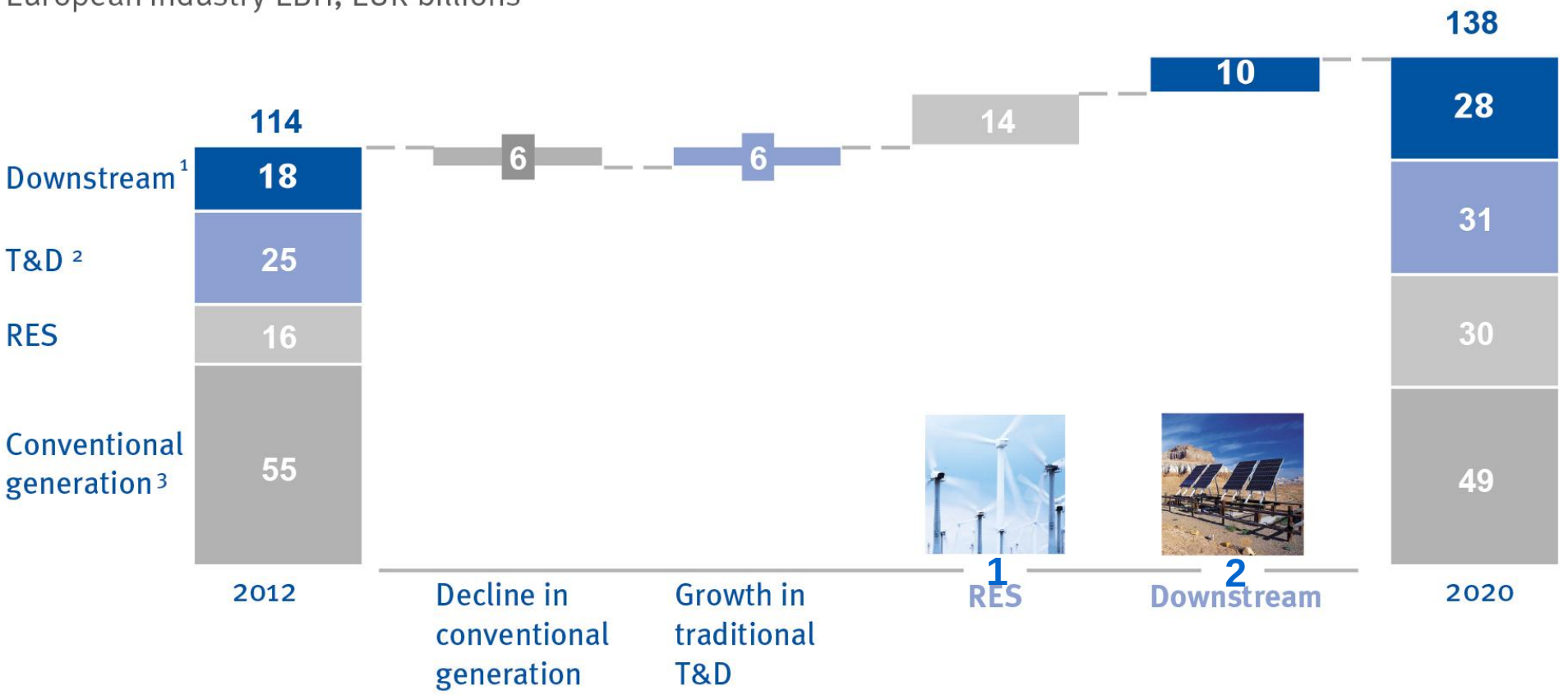
1 Utilities includes grid companies. Shareholder return shown is total shareholder return, calculated as the change in the share price plus the dividends paid, divided by the initial share price, and calculated on an annual basis

SOURCE: Datastream; McKinsey Industry Vision

However, growth is nonetheless possible

The good news – growth areas can offset the decline in traditional areas

European industry EBIT, EUR billions

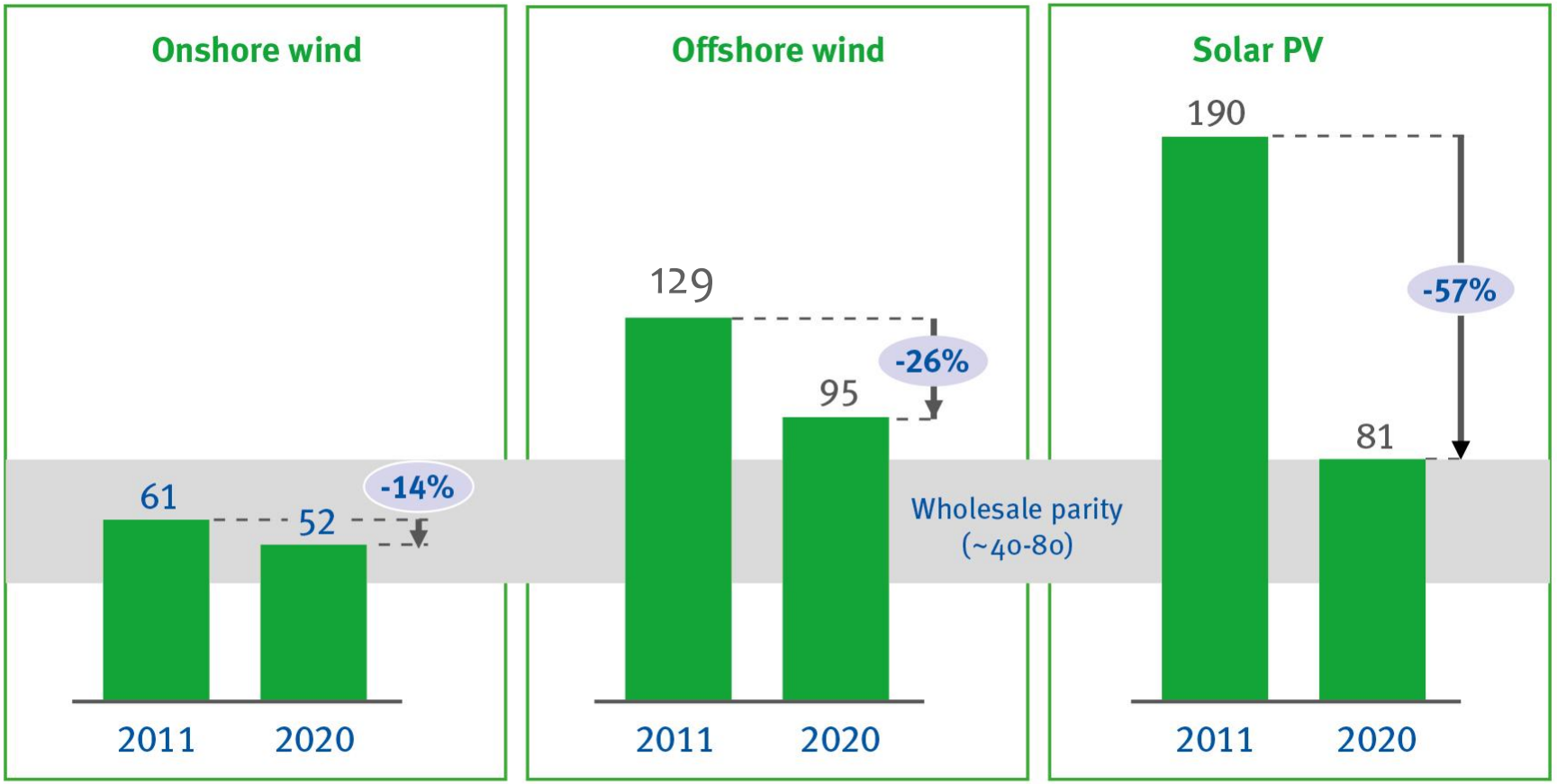


1 Includes power sales and new downstream (distributed generation and storage, electric vehicle infrastructure, new downstream products and services, power flow optimization)
2 Includes smart grids
3 Assuming no change in commodity prices vs. today

SOURCE: McKinsey Industry vision team analysis

1 The cost of key renewable technologies is expected to decrease by as much as 60% to 2020

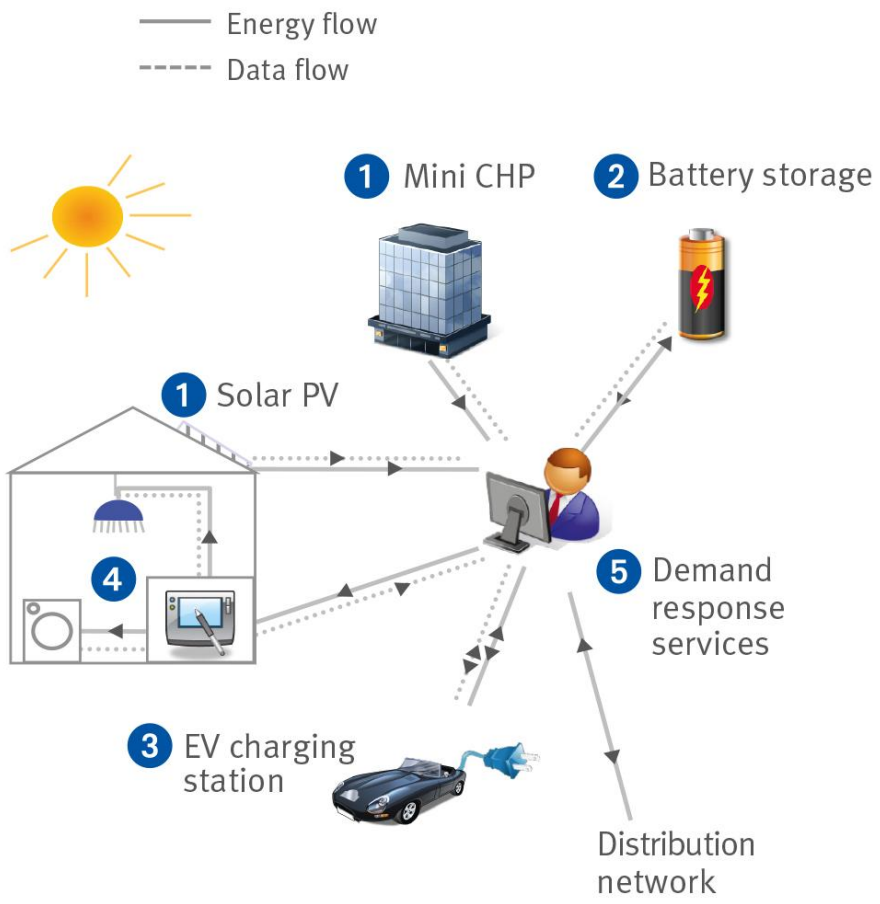
EUR/MWh[1]



1 Cost refers to the levelised cost of energy attainable using leading technology in favourable conditions. Assumptions include (2011, 2020): Onshore wind capex in EUR/kW (1188, 1108), load factor (36%, 39%), WACC 9%; Offshore wind capex in EUR/kW (3772, 2830), load factor (51%, 54%), WACC 10%; Solar PV capex in EUR/kW (2162, 927) , load factor (16%, 16%), WACC 7%

SOURCE: McKinsey Clean Technology Performance Initiative

2 New downstream value pools may emerge from the green agenda and new technologies



New downstream value pools

1 Distributed generation

Installation, maintenance, and possibly ownership of:

- Solar PV systems
- Mini/micro CHPs

2 Battery storage

- Ownership, installation, and maintenance of battery storage at local distribution level

3 Public infrastructure for electric vehicles

- Grid connection works
- Ownership, installation, and maintenance of public charging points

4 New products and services at customer premises

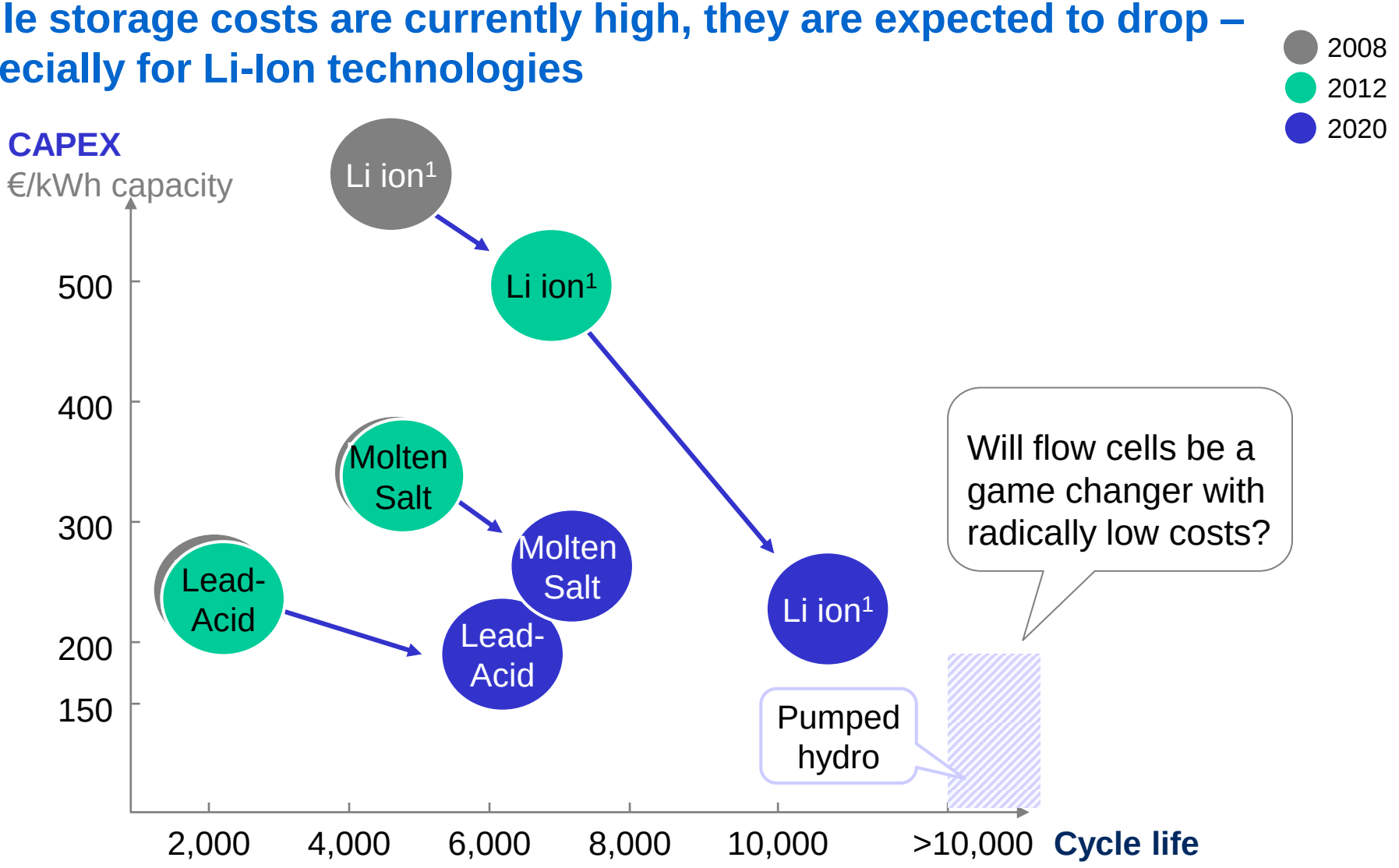
- Installation, maintenance, and possibly ownership of products that:
  - Increase customer comfort and enable new services
  - Make home and other buildings more efficient

5 Power flow optimisation

- Leverage local sources of net load flexibility (distributed storage, EV batteries, DSM, DG) to:
  - Optmise power flow at local and system level to manage congestions and stabilise grid
  - Shift net system load to capture price arbitrage opportunities

SOURCE: Industry vision team analysis

2 While storage costs are currently high, they are expected to drop – especially for Li-Ion technologies

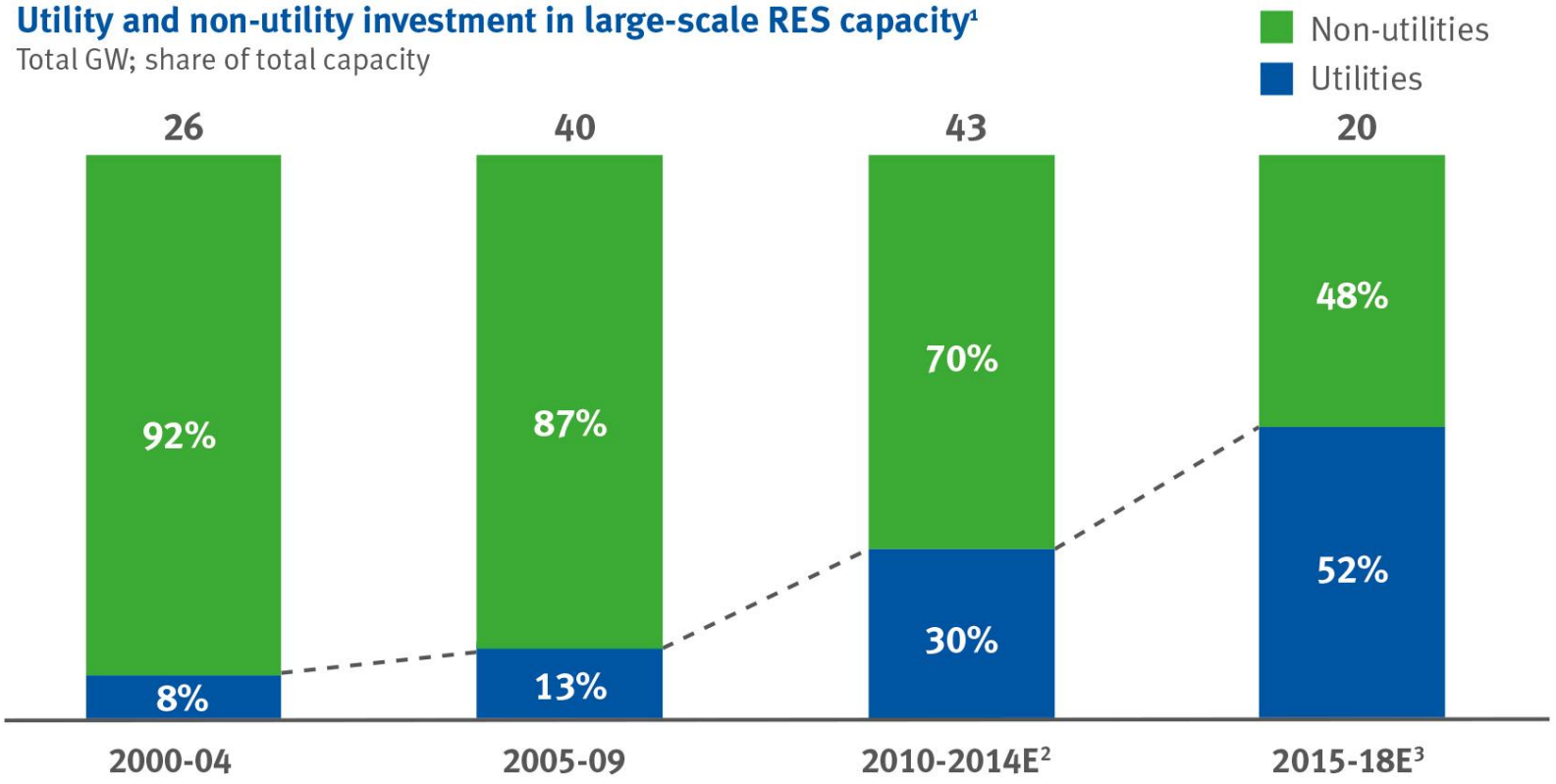


1 LFP/C Chemistry; based on costs for automotive applications

SOURCE: ESA; McKinsey


Utilities know their future depends on
Innovation

After a slow start, utilities now account for a majority of the pipeline of large-scale RES investment



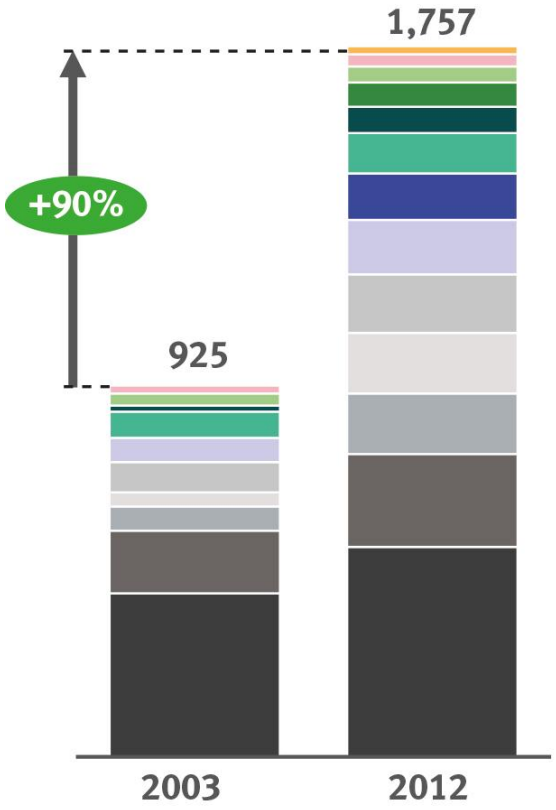
1 Includes installations of 10 MW or more across solar, biomass, and wind power
2 Based on completed projects and pipeline
3 Based on project pipeline

Source: Platts Powervision; EURELECTRIC Innovation Action Plan Taskforce analysis

R&D expenditure by large European utilities has nearly doubled over the last decade to over €1.7 billion

R&D expenditure by 13 major European utilities in early 2000s[1] and early 2010s[2]

EUR millions



- Statkraft
- CEZ
- Centrica
- SSE
- EDP
- Enel/ Endesa[4]
- Dong
- Iberdrola[3]
- RWE
- E.ON
- Vattenfall[5]
- GDF Suez[6]
- EDF

1 2003: Vattenfall, E.ON, Iberdrola, SSE; 2004: Dong; 2005: EDF, GDF Suez, Enel; 2006: Statkraft; 2007: CEZ, EDP, RWE; 2009: Centrica

2 2010: CEZ; 2011: Centrica, Dong, RWE, EDP; others 2012

3 Adjusted for acquisition of Scottish Power Ltd.

4 Adjusted for acquisition of Endesa

5 Adjusted for acquisition of Nuon Energy

6 Adjusted for GdF – Suez merger and spin-off of Suez Environnement Company.

Source: Capital IQ, company annual reports; EURELECTRIC Innovation Action Plan Task Force analysis

Innovation's calling: three imperatives stand out

Innovation

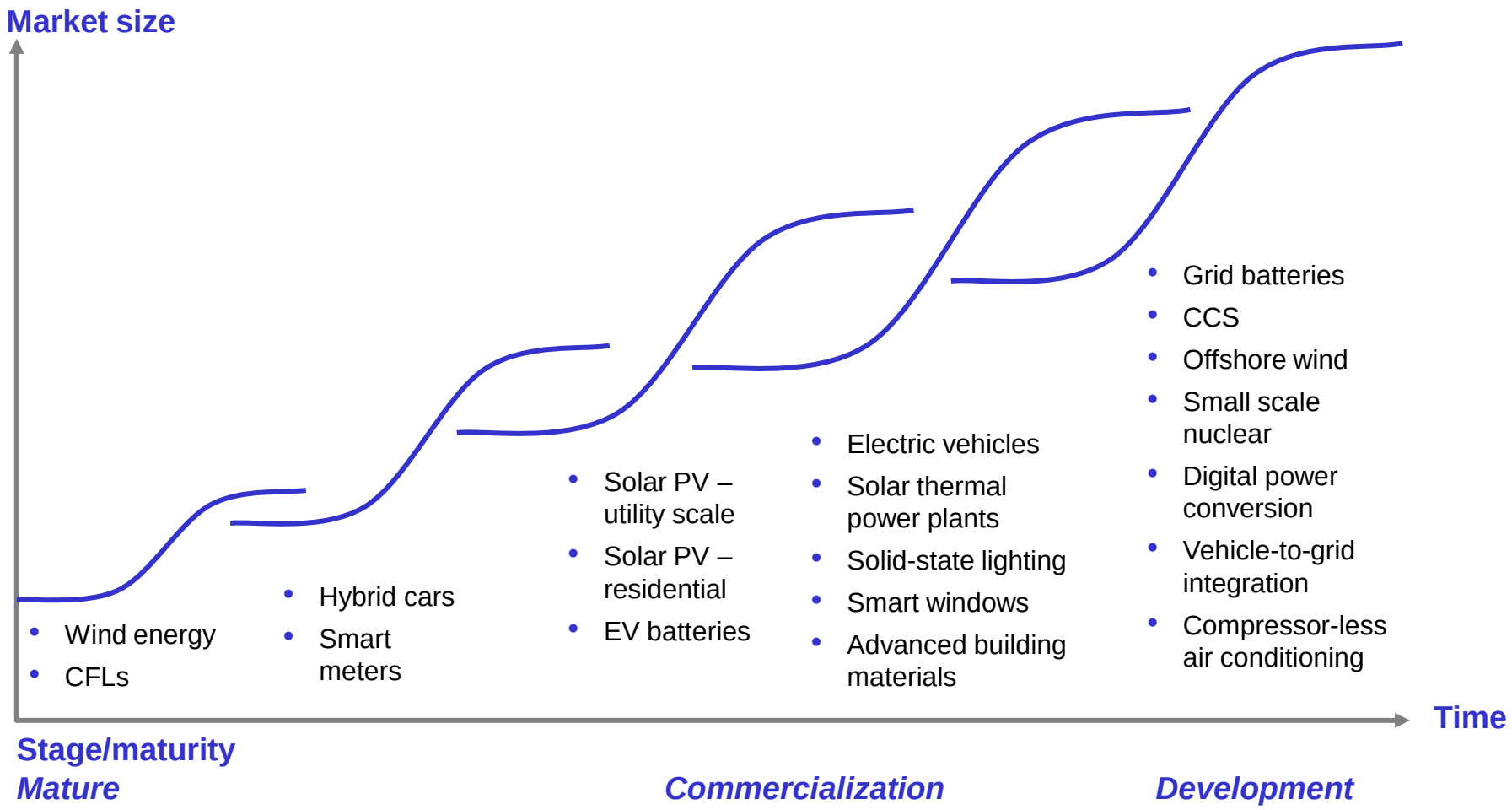
Mastering technology

Getting closer to customers

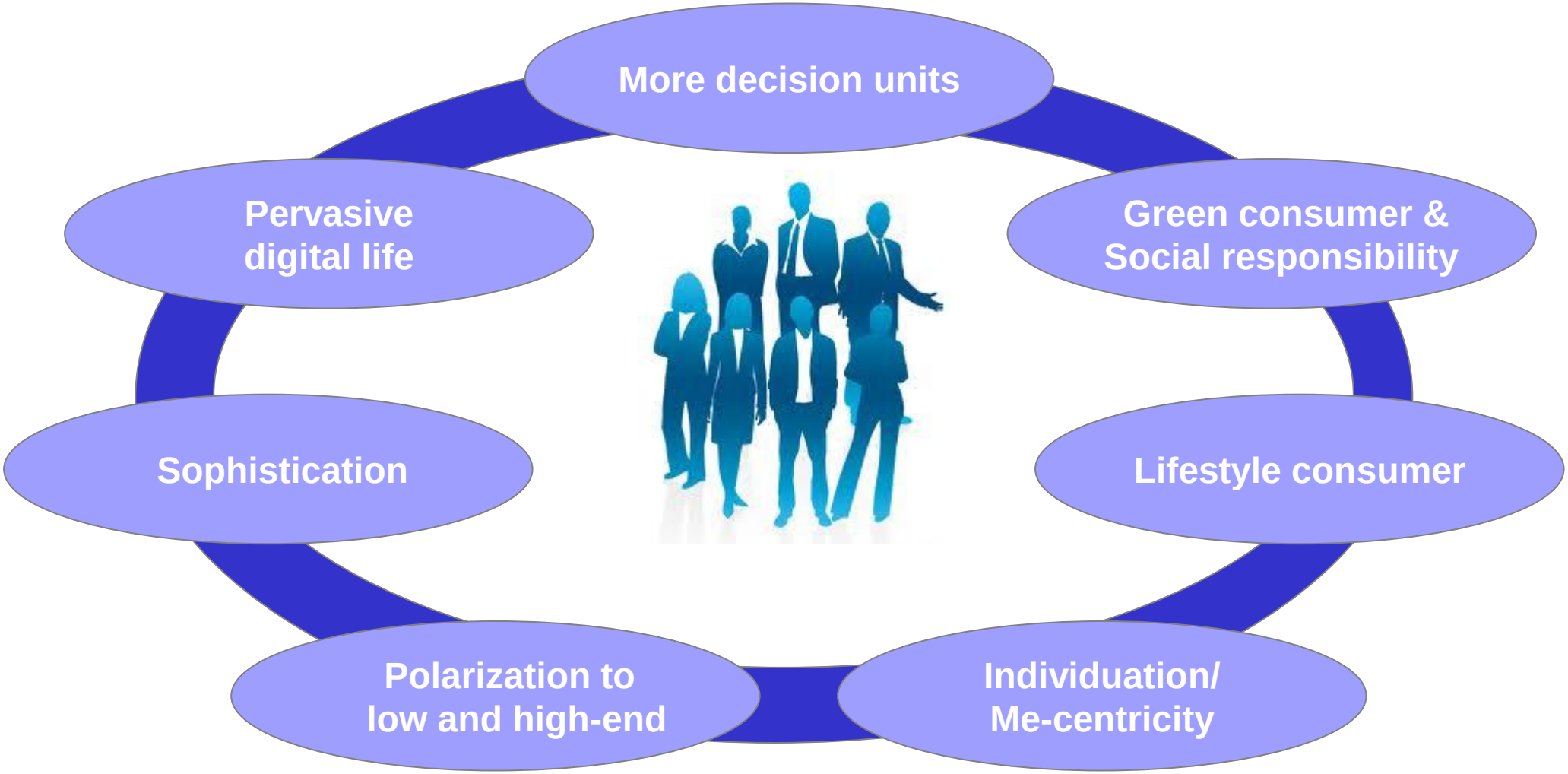
Developing new business models and services

Continued development of a large range of technologies could have disruptive impact on the power sector

Selected examples

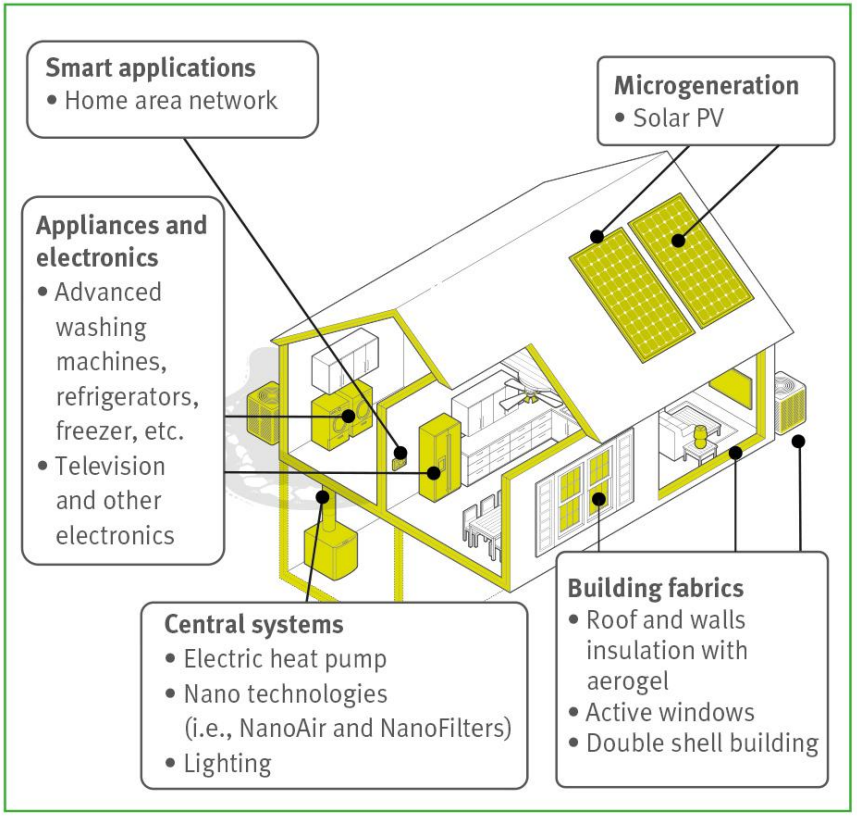


Getting closer to the customers



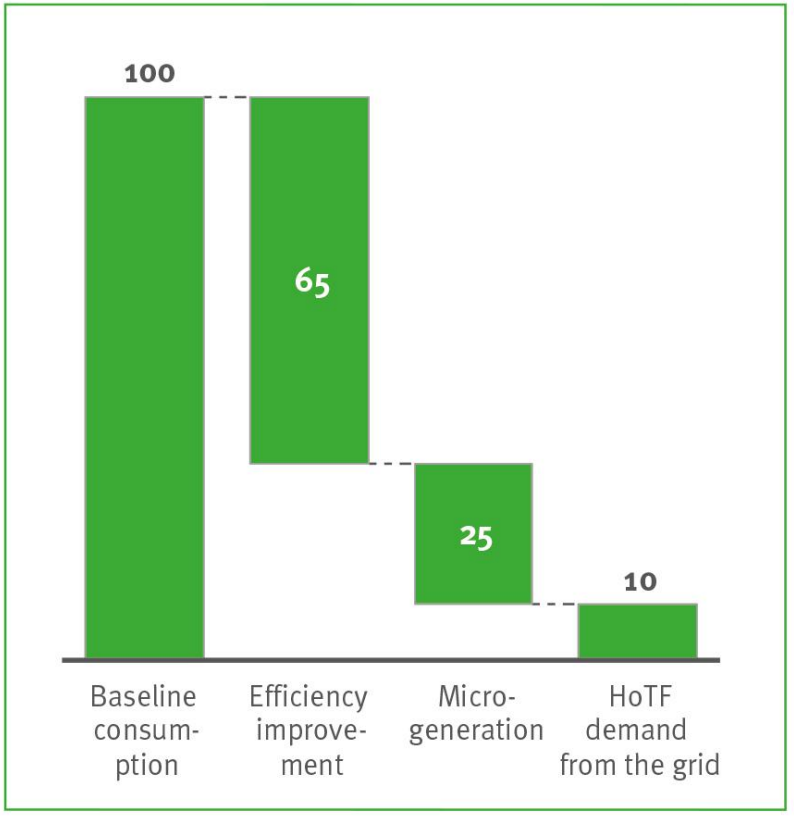
How to take advantage of the "home of the future" with smart meters, micro-generation, and a host of new services and appliances

The home of the future: example of a new single house



Decrease in energy needed from the grid by the HotF

2020, indexed, 100 = kWh of household consumption

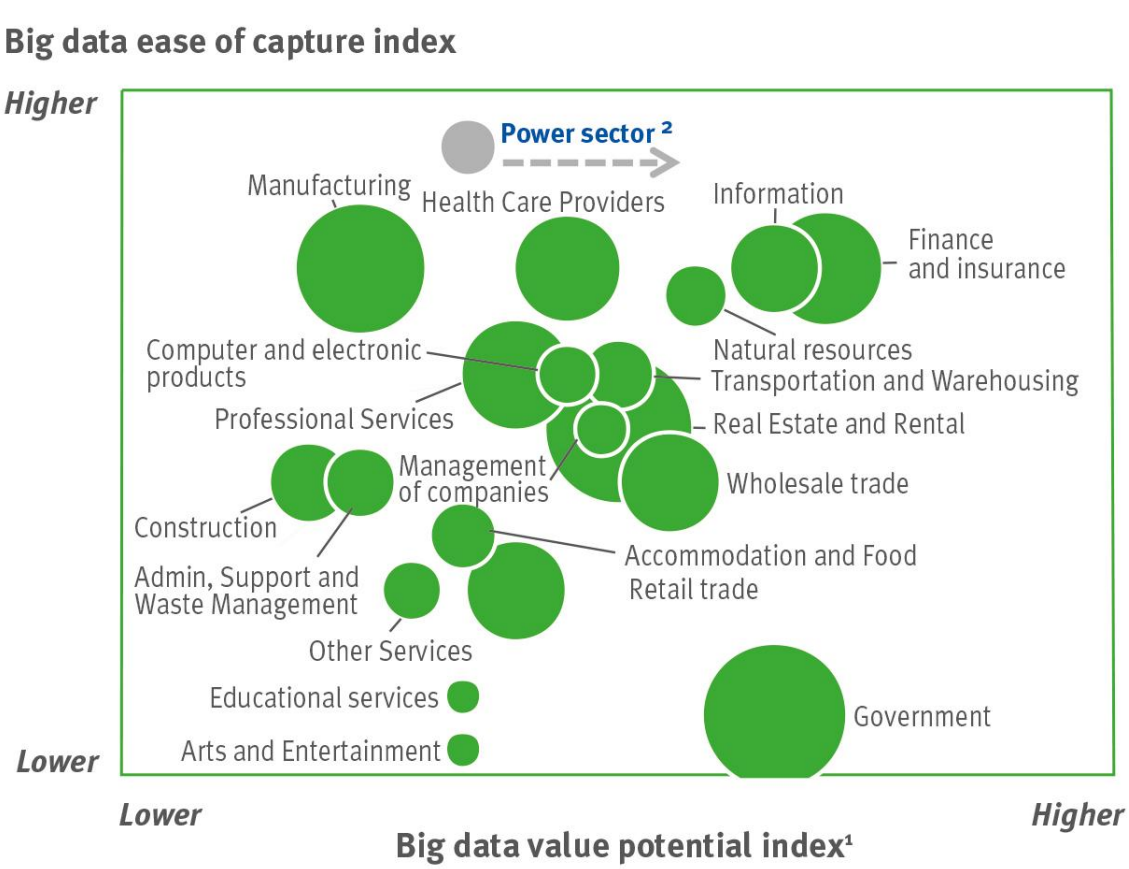


SOURCE: McKinsey Home of the Future Initiative

How to capture value?

Moving from sales of commodity to services, i.e., from €/MWh to €/customer?

Big data is easier to capture in the power sector than in many other industries, and its potential value is rising



Bubble sizes denote relative sizes of GDP[3]

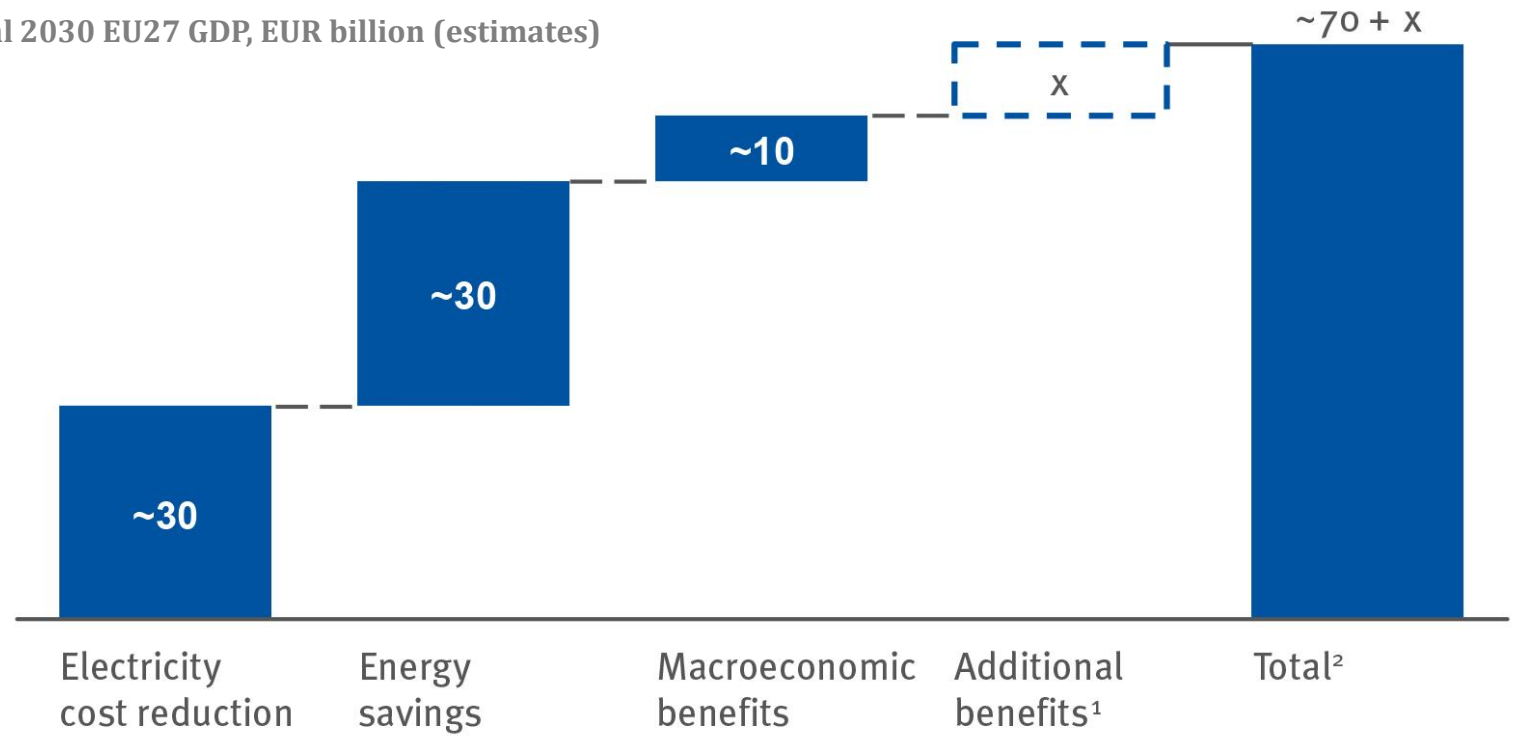
- Power sector players are well positioned to capture large amount of data
- Sources of value from big data for power sector players
  - Tailored/new products & services
  - Enhanced customer targeting
  - Enabling of demand side management
  - Optimized operations

1 Potential to create value. Some portion of the value created can be captured as profits
2 Electricity and gas utilities
3 based on US GDP data

SOURCE: McKinsey Global Institute

All in all, an innovation breakthrough in the EU power sector could be worth €70 billion to the EU economy in 2030, increasing thereafter

Additional 2030 EU27 GDP, EUR billion (estimates)

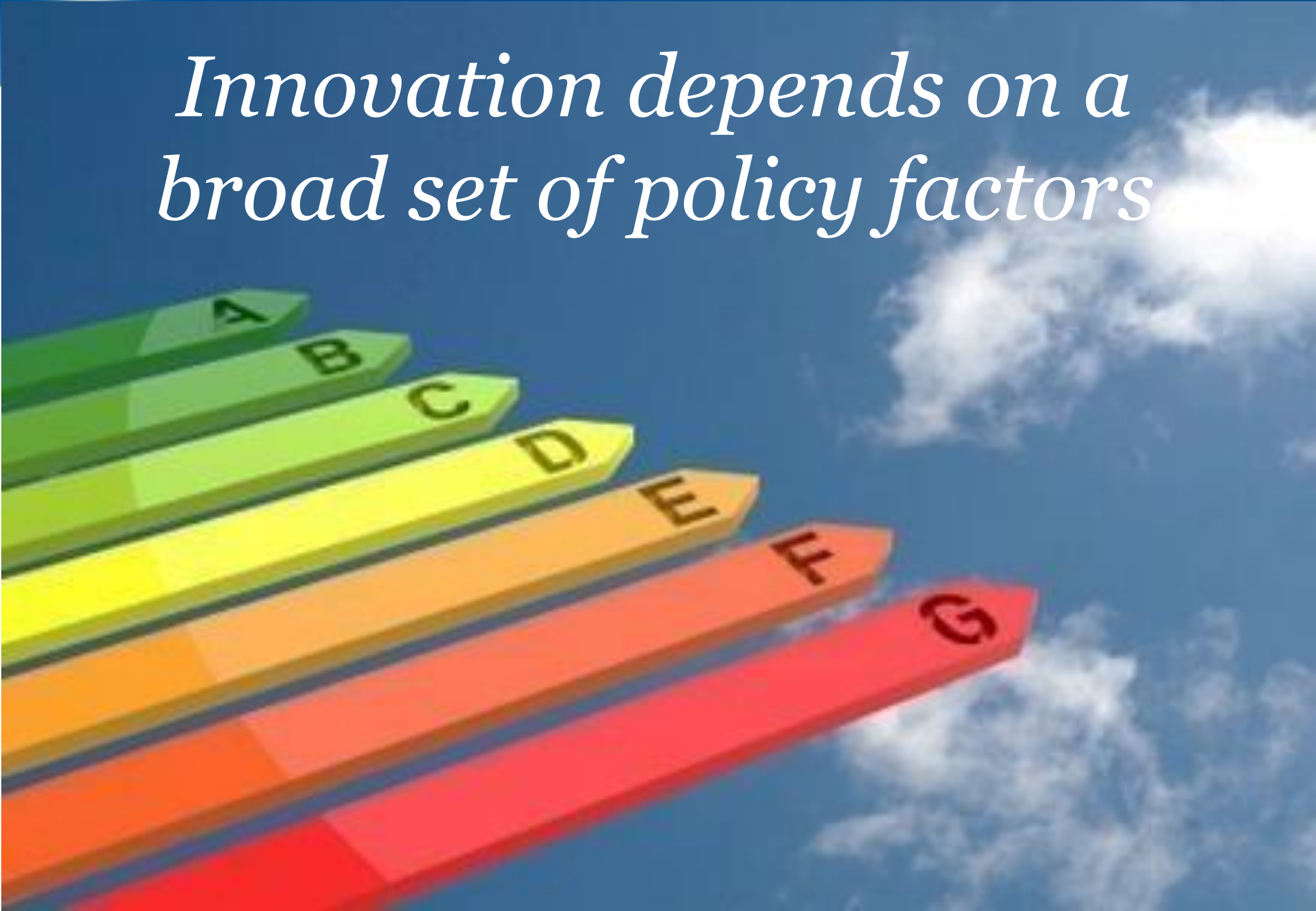


1 Additional innovation benefits not included in this calculation could include reduced costs of balancing the power system, improved consumer convenience and value, additional economic benefits or contributions to EU objectives through accelerated electrification of transport and heat, and clean technology and other business opportunities that could be captured by European industry in the context of an expanded global market.

2 The estimate is of additional gross domestic product, and in total corresponds to 135 EUR per capita in 2030. The benefits would be shared between households and companies consuming energy, electric utilities and other companies in the electricity supply chain, and various other actors throughout the wider economy.

SOURCE: EURELECTRIC Innovation Action Plan Taskforce analysis

Innovation depends on a broad set of policy factors



The broad range of innovation means R&D is only a beginning – a wide range of policy factors act on and enable innovation

1 RD&D funding

- **Pre-market instruments** focused on **knowledge production** – including **demonstration**
  - Funding (grants, tax credits, PPPs), risk reduction

2 Support for commercialisation and deployment

- **Market interventions** to promote step from RD&D towards **commercial application** and also to **indirectly reward RD&D**
  - E.g., patents, subsidies, procurement, venture support

3 Enabling setting

- **Regulation and infrastructure that provide incentives and prerequisites for the innovation process**
  - Market competition and regulation, infrastructure

4 Collaboration and networks

- **Networks** to promote and **disseminate innovation** and **improve talent-pool**:
  - Networks, education, publication, standardisation

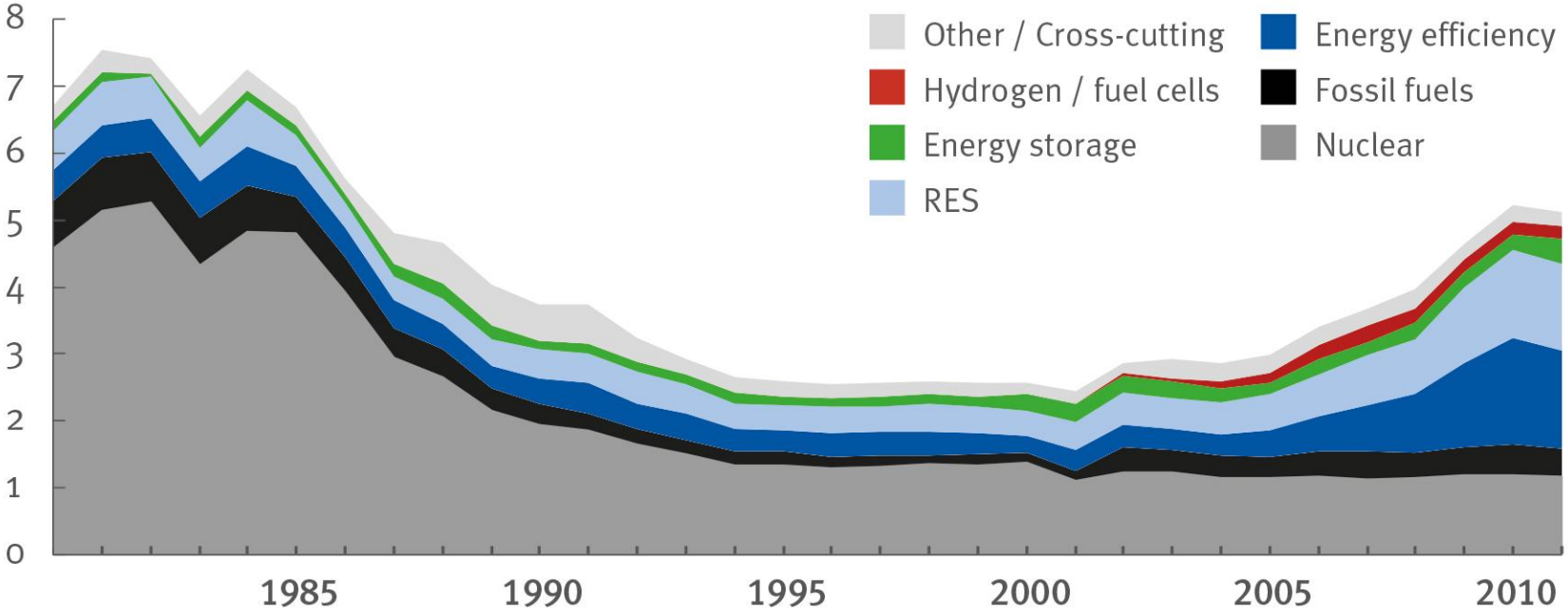
SOURCE: Executives survey, CTO and policy-makers interviews; EURELECTRIC Innovation Action Plan Taskforce analysis


Effective R&D and demonstration is the seedbed of innovation

Public EU investment in R&D is growing, largely through increases in renewables and energy efficiency

IEA Europe public RD&D funding for energy technologies, 1980-2011[1]

USD billions (PPP); 2011 prices

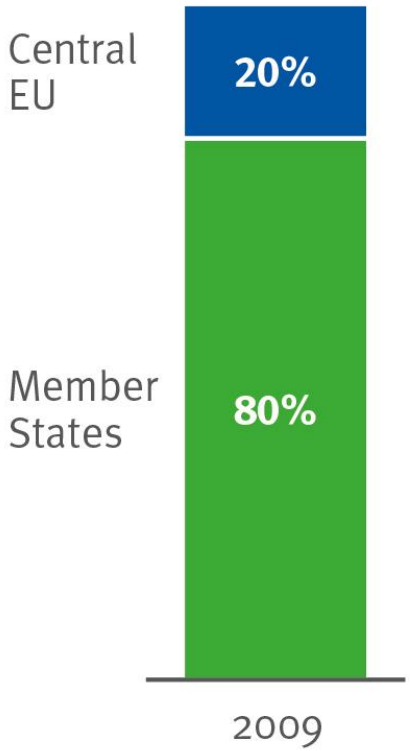


1 Data covers EU IEA member countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Spain, Sweden, and United Kingdom, as well as EU-level funding

SOURCE: Energy Technology RD&D 2012 edition © OECD/IEA 2012; EURELECTRIC Innovation Action Plan Taskforce analysis

Also, industry executives find that EU funding of power sector R&D suffers from fragmentation and lack of direction

The majority of public funding is disbursed by Member States...



...but lack of coordination leads to fragmentation and duplication

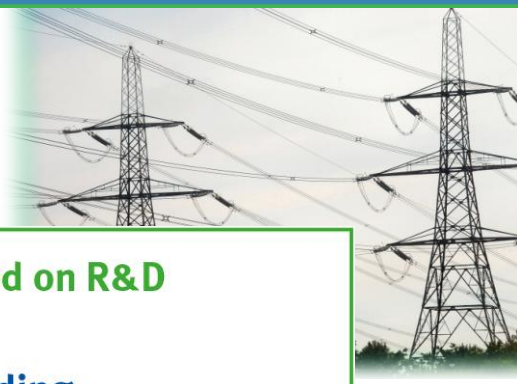
*'**R&D efforts are often duplicated** across countries without coordination'*
– EU policymaker

*'Policies on European level are required – **boundaries between countries need to be broken**'*
– EU utility executive

*'We need one integrated European energy market with **one European energy & environmental policy**'*
– EU utility executive

SOURCE: European Commission; SET Plan; Eurelectric, Innovation Action Plan Survey; CTO and policy expert interviews; EURELECTRIC Innovation Action Plan Taskforce analysis

Demonstration is central to power sector innovation but risks being deprioritised



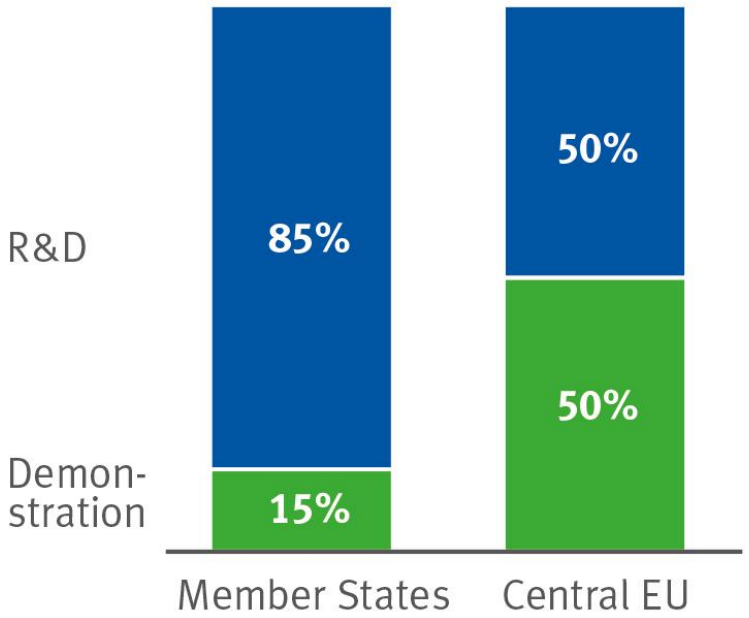
Demonstration is needed...

*'The EU should **sponsor development** rather than research – a lot of research is not aligned with needs'*
– EU utility executive

*'Policy needs to take into account that innovation in the electricity sector implies a **demonstration phase** after research and before roll out'*
– EU utility executive

...but funding is concentrated on R&D

EU and Member State RD&D funding
% of total RD&D funds



SOURCE: European Commission; SET Plan; Eurelectric, Innovation Action Plan Survey; CTO and policy expert interviews; EURELECTRIC Innovation Action Plan Taskforce analysis

Innovation needs an enabling business environment

The need to go beyond R&D came out strongly from the survey of utility executives and innovation experts

SOURCE: Eurelectric, Innovation Action Plan Survey, December 2012; CTO and policy expert interviews

EU policy has heavy focus on deployment to encourage innovation

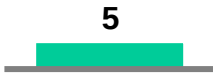
"R&D"

A **Role in innovation:** Feeds long-term pipeline of ideas, crucial role in key innovation of past decades

B **Limitations:** Touches only part of innovation chain

C **EU track record:** Now growing, but fall from 11% to 4% of public R&D, 1980-2011

EU energy R&D funding, 2011
EUR billion



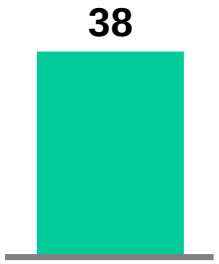
"Deployment"

A **Role in innovation:** Incentives for private R&D; enables industrialisation, learning by doing

B **Limitations:** Risk of "picking winners" and going down dead ends

C **EU track record:** Strong commitment, but focus on near-mature technologies?

EU RES subsidies, 2011
EUR billion



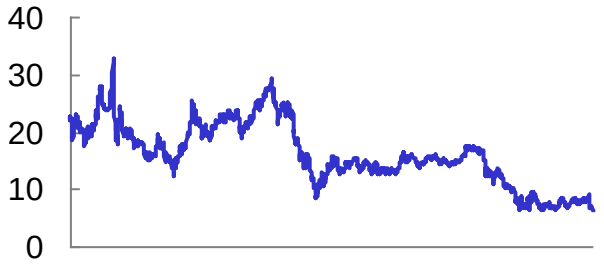
"Pricing"

A **Role in innovation:** Technology-neutral deployment, competition between rival solutions

B **Limitations:** Unfeasibly high prices required for immature technologies

C **EU track record:** ETS in the doldrums

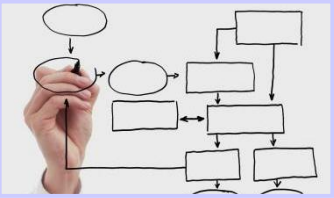
EU ETS CO_2 prices
EUR / tCO_2



SOURCE: EURELECTRIC Innovation Action Plan Taskforce

Five actions to improve EU enabling of power sector innovation

1. **Adopt a systems approach –** make innovation policy a tool of energy policy through an integrated perspective on the overall power system



2. **Nurture public-private dynamics –** harvest the low-hanging fruit: innovation through a competitive, business-friendly, and risk-rewarding market framework

3. **Prioritise demonstration and commercialisation –** strengthen support mechanisms that take innovation beyond R&D

4. **Unlock downstream innovation –** put in place the enablers of a 'new downstream' set of services and offerings: competitive markets, smart regulation, and enabling infrastructure

5. **Create supportive governance for the innovation union –** improve coordination and governance of both EU-level and Member State support mechanisms

THANK YOU!

If you have any questions, do not hesitate to get in touch with us!

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