CINELDI webinar

How can the distribution grid be adapted to facilitate a large-scale electrification of the society?

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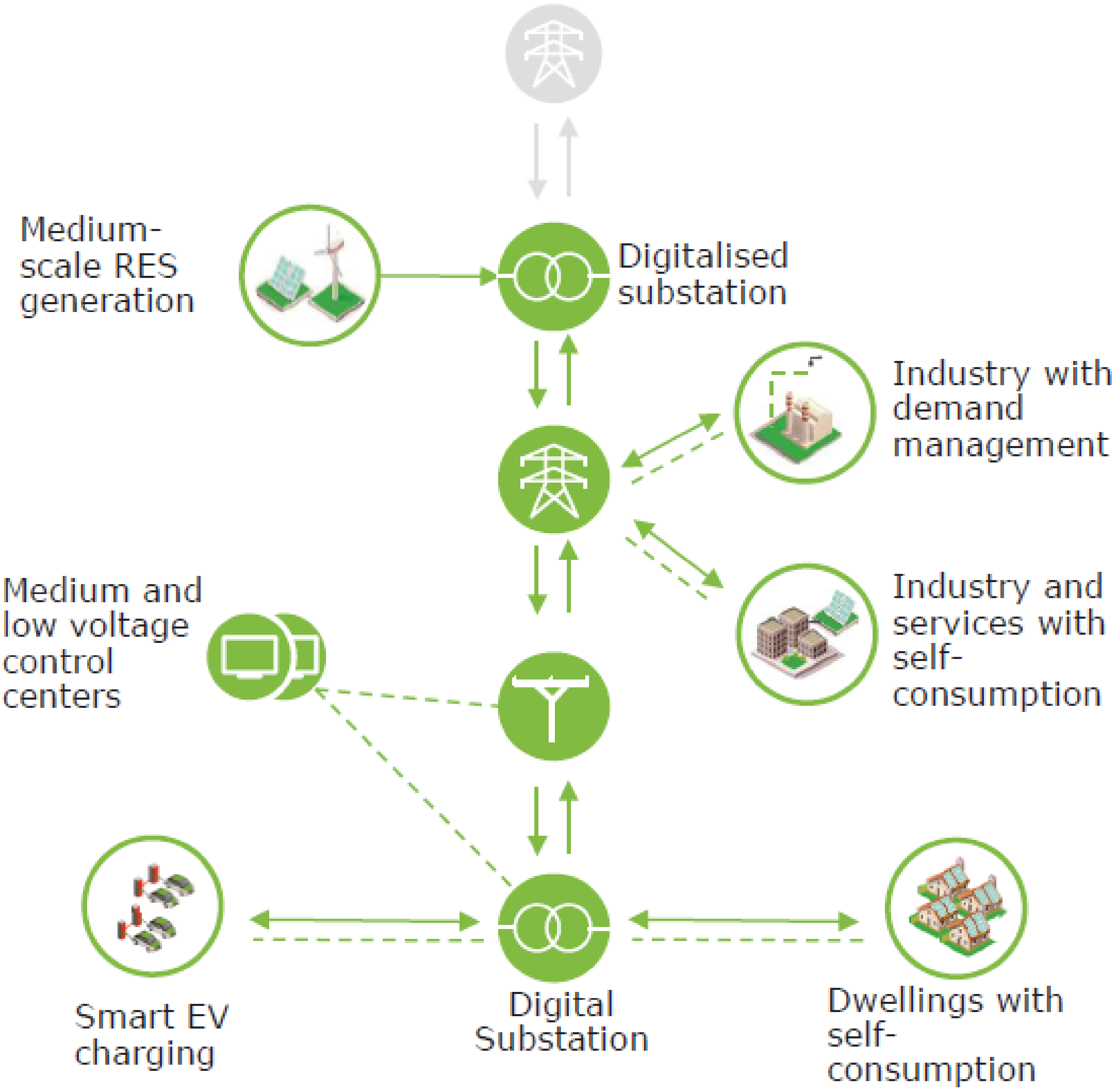


Power Distribution Grid of the Future

Optimisation of grid planning and anticipation of investments are key to reduce power grid investments needs within the Energy Transition

Massive energy system changes needed by 2030

Electrification

- +40-50m heat pumps
- 50-70m electric vehicles
- +335 TWh (add. demand) industrial and P2X

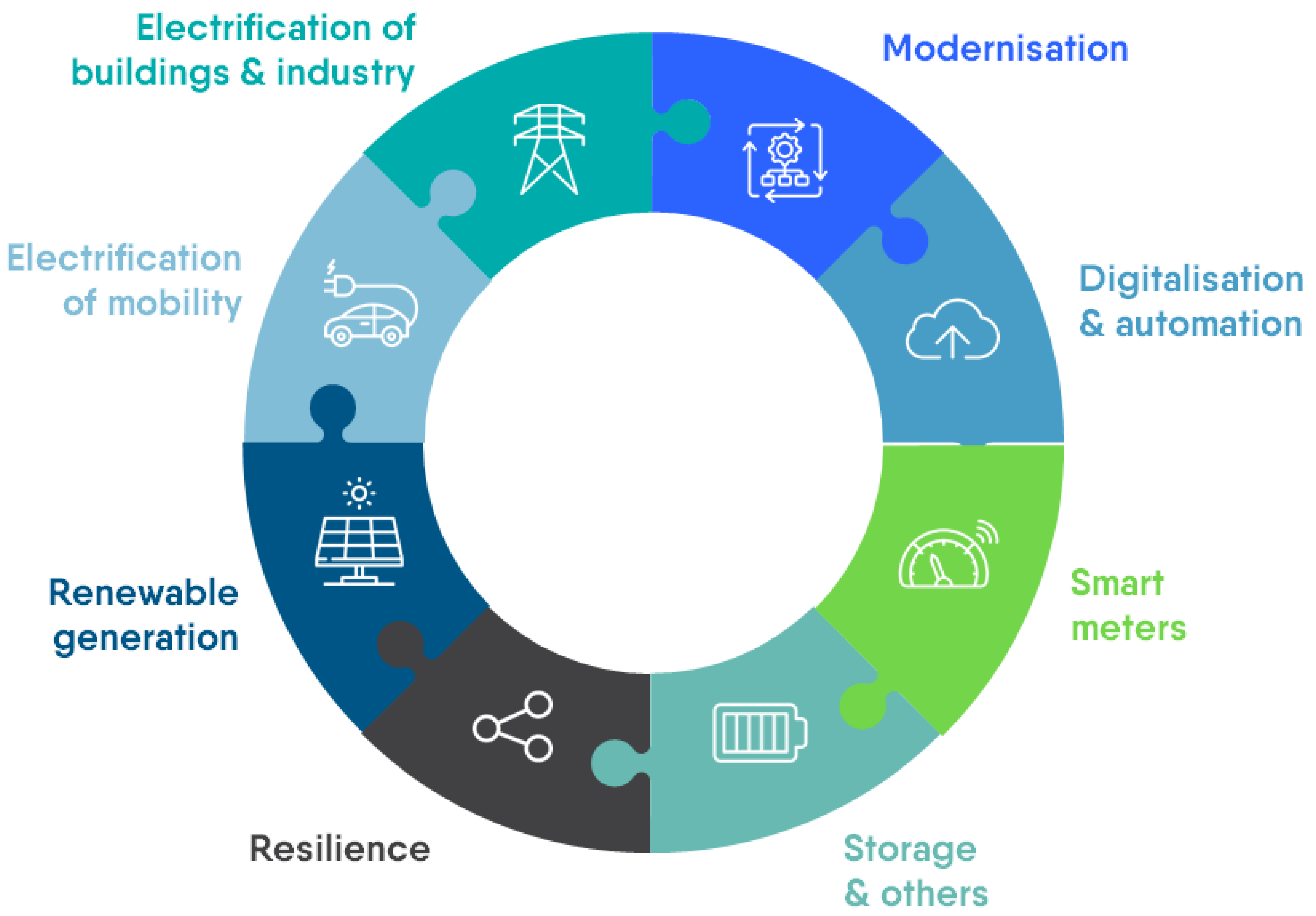
Emission-free generation

- +470 GW centralised renewables
- +40 GW self-consumption
- ~70% renewable capacity connected to distribution grids

Energy efficiency & conservation

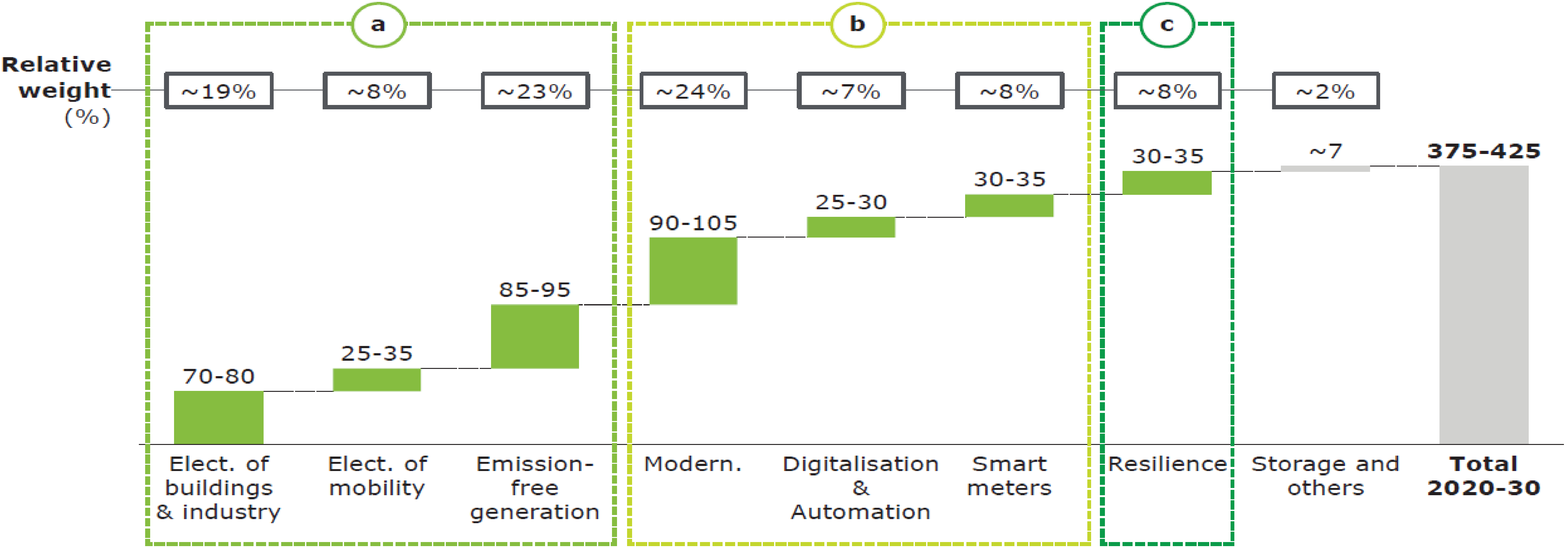
- >50% EV charging in off-peak hours
- Foster the roll-out of smart meters

Distribution grid investments should focus on 8 key drivers



3 Distribution grids will require 375-425 €bn of investments during 2020-2030 in EU27+UK

EU27+UK DSO investments in power distribution grids breakdown per relevant investment drivers
(nominal €bn; 2020-30)



We consider cost-effectiveness in our scenario through load flexibility measures, e.g. smart EV charging (i.e. diversified EV charging) reducing the economic impact of electrification of mobility

Source: DSOs and national associations; Monitor Deloitte

70% of new 510 GW RES capacity will be connected at distribution level

	RES capacity additions (GW; 2017-2030)	New RES connected to DSO grids (%; 2017-2030)	Self-consumption capacity additions (GW; 2030)	Cumulative RES capacity (GW; 2030)
EU27+UK	~510	~70%	~40	~940
Germany	98	~93%	9.0	179
Spain	65	~25%	2.3	119
France	65	~85%	~1	111
Italy	42	~83%	~0	95
Denmark	15	~37%	0.2	22
Poland	15	~67%	6.6	24
Portugal	14	~56%	1.9	27
Sweden	12	~30%	n.a.	38
Ireland	10	~43%	0.2	13
Hungary	6	~90%	n.a.	7

Source: Eurelectric; DSOs and associations; Monitor Deloitte

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Grid investments have major societal benefits

SUSTAINABILITY

€17-22bn annual CO_2 savings

€40-140bn annual savings in health

58,000 premature deaths avoided

460 Mtoe less of final energy consumption by 2030, achieving 32.5% of efficiency target

ECONOMY

€ 30-35 bn of annual revenues for EU companies (e.g. manufacturers & service providers)

440-620k quality jobs per year related to DSO grids

€30-35bn annual sales in equipment (~90% of total investment)

COMPETITIVENESS

Territorial cohesion and promotion of local economies

€28-37bn average electricity cost reduction (thanks to 50-65% lower RES than fossil generation cost)

+€175bn annual savings in fuel imports

CUSTOMER EMPOWERMENT

~40 GW self-consumption capacity added

50-70m EVs with smart charging

New services: storage, electric heating, smart appliances, aggregators

~0.2-0.3% of current EU GDP in annual investments in power distribution grids

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Distributed Energy Resources (DER) integration requires, among other equipment[1], digitalisation, automation and communication across the MV/LV grid

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Simplified scheme of self-consumption and smart charging integration in power distribution network

Smart Equipment and Usage

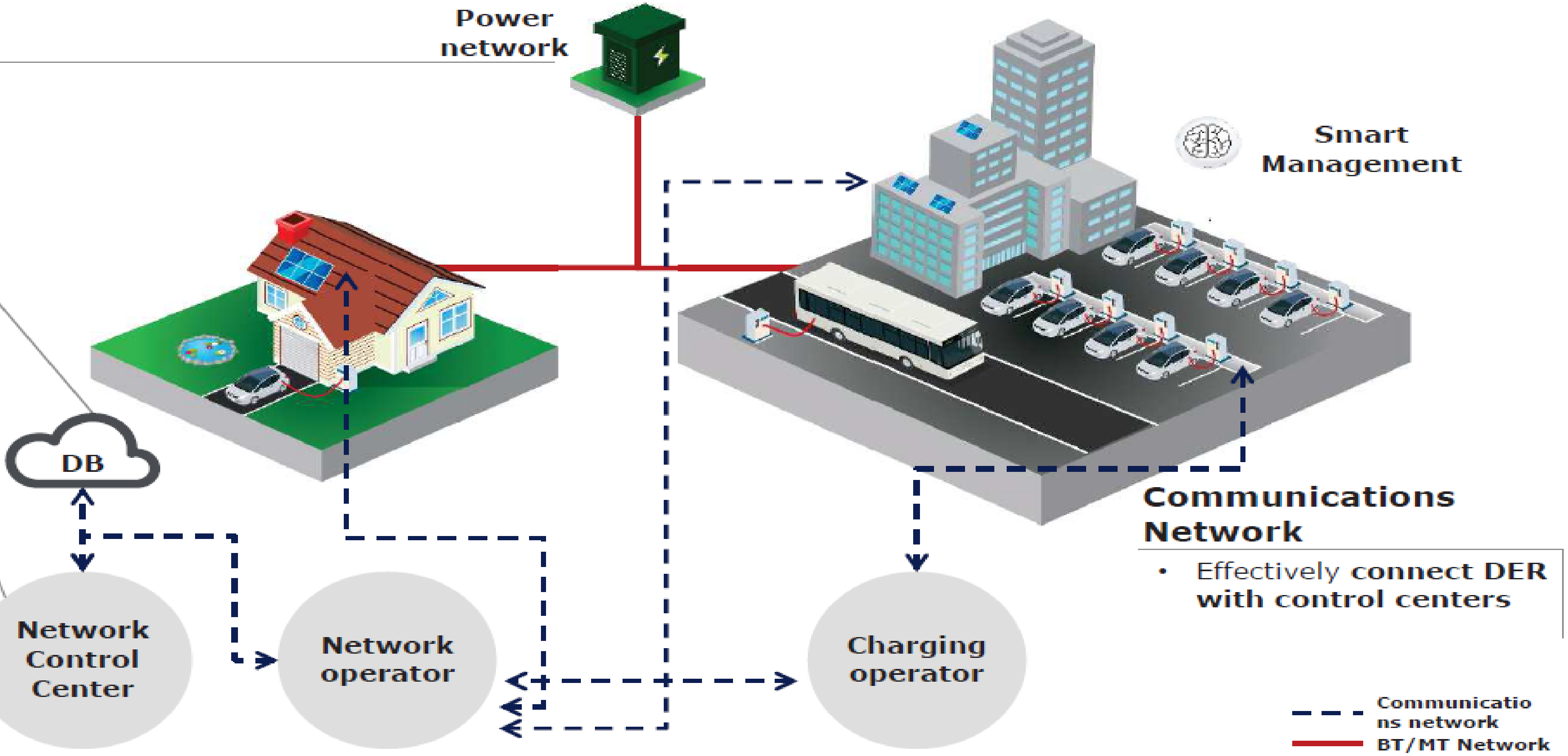
- **Monitoring and remote control** of power grid and DER (EV charging, self-consumption, distributed and large scale storage)

Information Systems

- **Cloud data storage and energy management software/systems** to process information and optimize the integration of DER with demand

Advanced Algorithms

- **Self-learning algorithms** with collected data from DER



Communications Network

- Effectively connect DER with control centers

Smart charging systems coupled with distribution grid digitalisation could significantly reduce the investments needed in power grids

(1) For example, new equipment such as line up-ratings and transformers for short circuit ratings driven by inverters

Source: Eurelectric; DSOs and associations; Monitor Deloitte

Remuneration parameters

	Current issues	Regulatory recommendations
Principles	Remuneration is designed for a low disruptive environment and does not capture future power grid costs Benchmarking models focused on short term cost reduction bearing the risk of underinvestment	• Enable forward-looking remuneration schemes that focus in effectiveness and enable adaptation to disruption and the energy transition requirements. The implemented mechanisms should be predictable and stable in the outcome, taking into account the asset depreciation • Remunerate adequately transformational assets (e.g. rate of return for innovative investments or useful life for digital assets)
Process	Delays in the development of regulatory reviews that may jeopardise investments required for the Energy Transition	• Facilitate adaptive remuneration review processes, to ensure that approved investments and remuneration adapt to potential Energy Transition disruptions • Reduce remuneration/cost review process duration to avoid putting energy Transition investments at risk (e.g. reduce delays in revenue cap definition)

Incentive models should be adapted

	Current issues	Regulatory recommendations
Incentives	Skewed towards short term cost reduction, remuneration does not consider benefits related to Energy Transition for incentive definition	• Facilitate incentives for both CAPEX and OPEX, taking into account the different nature of regulatory treatment. • Acknowledge an increase of operational costs in the deployment of innovative network technologies whenever it is the most efficient solution, considering long-term system-wide benefits • Evaluate benefits related to the Energy Transition (i.e. through a proper cost-benefit analysis), grid losses, fraud prevention, resiliency and structural development criteria (e.g. medium to long-term benefits across the value-chain, including output based incentives when appropriate) • Enable technology neutral incentives, to foster that DSO invest in the most optimal solutions, whether it is delivered by flexibility or grid assets. The remuneration of the expenses due to the implementation of innovative initiatives should be guaranteed and could be based on output methodology
	Increased pressure for OPEX reduction leading to lower incentive to enable power system cost optimisation, with risk of not incentivising flexibility and new technologies	

Regulatory parameters are key drivers for investment dimensioning

Enabling flexibility use requires an integrated framework at both national and European level

Cross border integration & interoperability	**Facilitate a EU regulatory framework** that ensures market interoperability and cross border integration of flexibility
Roles	**Define responsibilities** among parties to deliver flexibility services
Smart Infrastructure	**Assess flexibility potential across power system infrastructures** and create a plan to exploit it (e.g. locations, facilities, new technologies) depending on particularities of the grid infrastructure
Economic signals	**Facilitate the right incentives for DSOs and market players** to ensure: – **An optimal mix** between investments and flexibility, **that minimises the long-term costs and maximises benefits for society** – **Cost recovery with an appropriate margin/return for the DSO**, including required ICT and infrastructure costs **Develop mechanisms (e.g. tariffs, grid products) for flexibility providers,** that enable efficient price signals, depending on country conditions
Information	**Enable efficient data exchange and coordination procedures among parties** for optimal utilisation of resources, as well as the secure and efficient operation

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Flexibility[1] could reduce some investment needs in power grids; however, it is under some uncertainties (e.g. regulation, adoption), and there are trade-offs to consider

ILLUSTRATIVE EXAMPLE

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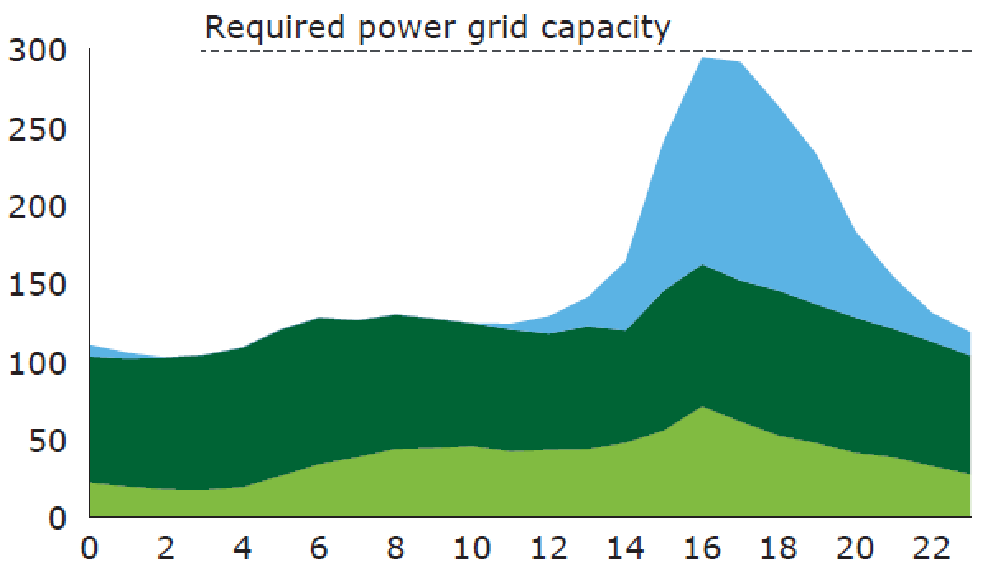
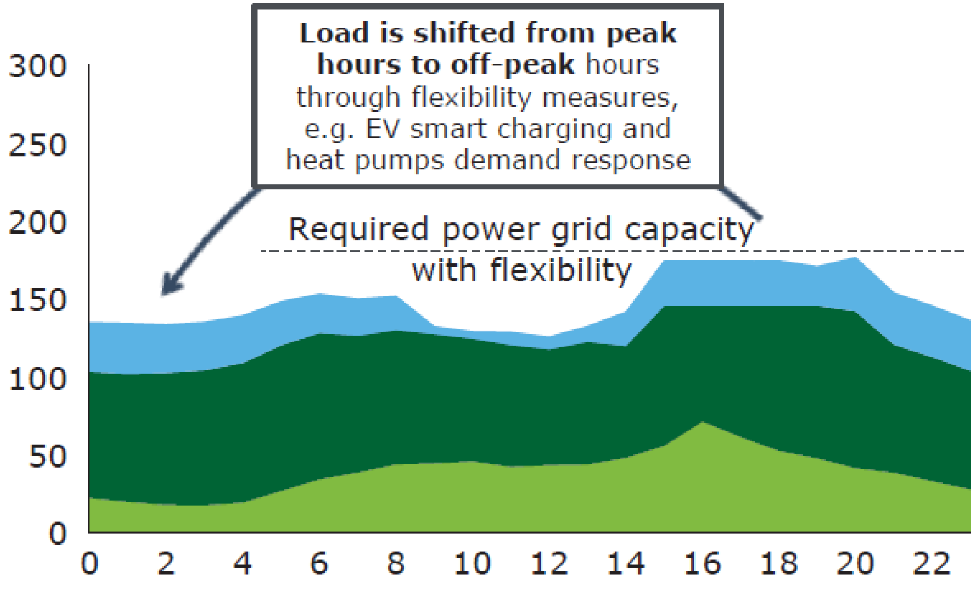
Illustrative average hourly electricity consumption in the low-voltage grid in the residential sector[2]
(kW)

Example without representative load flexibility measures



Example with representative load flexibility measures



Electric vehicles | Individual Heat Pumps | Other residential consumption

Flexibility could be a key factor for power system cost optimisation, but there is still uncertainty about its potential impact and will depend on the development of regulation, markets, etc.

(1) Flexibility can include load flexibility measures (e.g. demand response), generation flexibility measures (any generator which voluntarily increases/decreases its production to create flexibility) and storage flexibility measures (e.g. batteries for EV). This example focuses on load flexibility measures.
(2) Simplified example to show how flexibility works when it is available in the system. Low voltage feeder with 48 houses, with each house having a heat pump and a BEV with a 3,7 kW (single phase) charger

Source: Dansk Energi; Monitor Deloitte

Flexibility is Critical

Electrification calls for heating and mobility to go electric.

Both are highly flexible and local, calling for optimal use at distribution level

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Thank you for your attention