Developments in Electrification and Implications for the European Electric Industry

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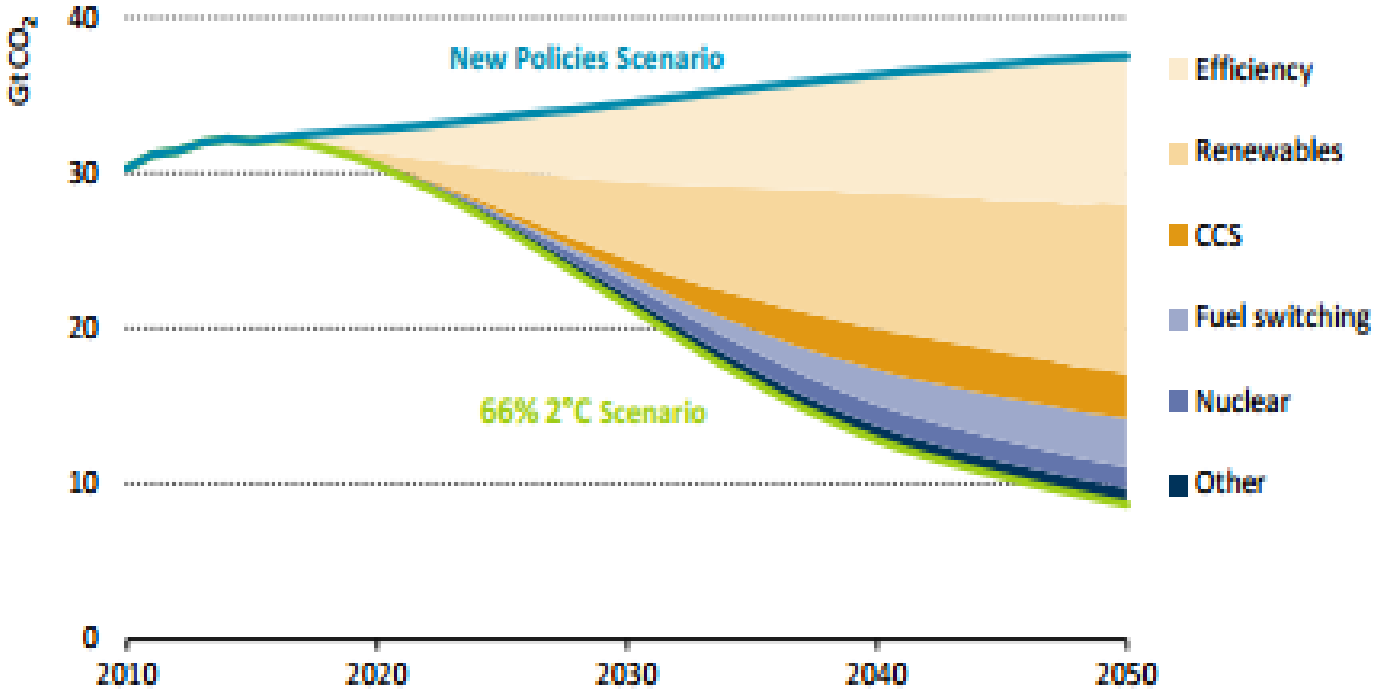
Filling the Paris Agreement ambition gap

The energy transition will have to be extensive, deep and fast

Global emission abatement in the 66% 2°C Scenario



A drastically different landscape in 2050

- Low-carbon electricity representing 95% of the energy mix
- Nearly 70% of new cars will be electric
- The entire existing building stock retrofitted
- CO_2 intensity of the industrial sector 80% lower than today

Source: IEA-Irena, Perspective for the energy transition, 2017

The role of electricity in a low carbon world

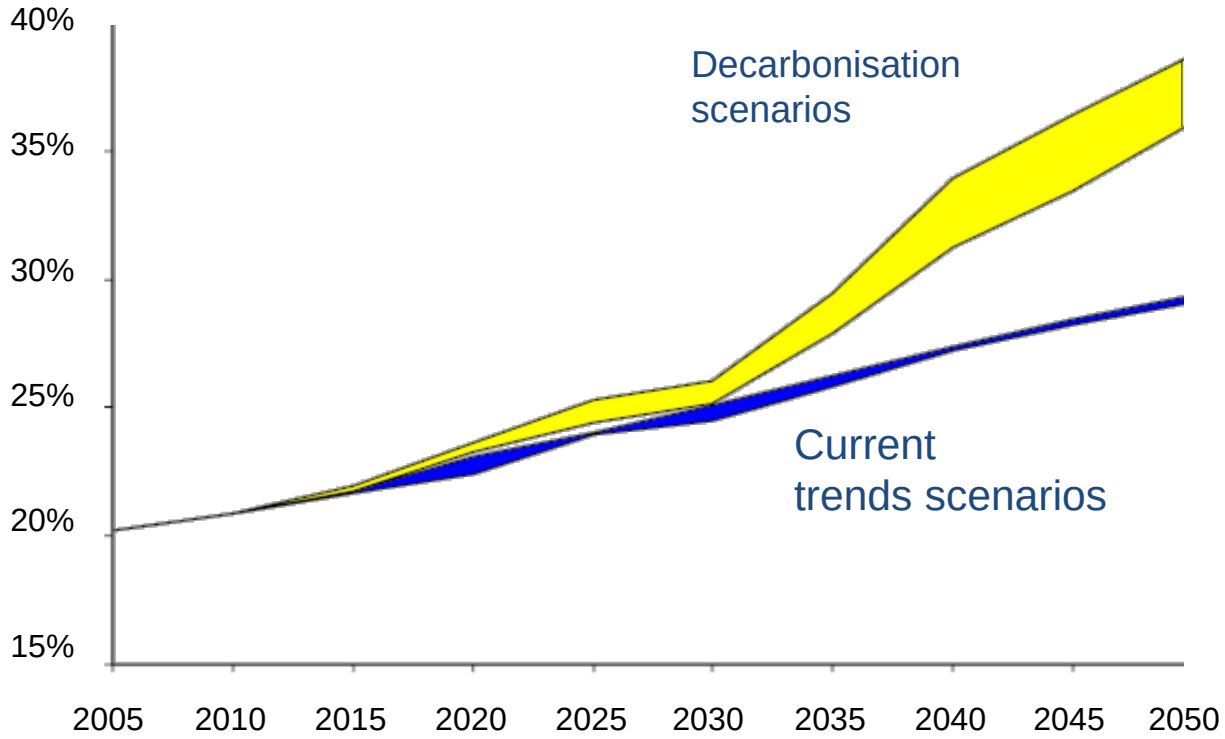
A growing contribution to the decarbonisation of transport and H&C

The EU 2050 Roadmap tells us:

‘ All scenarios show electricity will have to play a much greater role than now […] and will have to contribute to the decarbonisation of transport and heating/cooling’

The question becomes:

“Why wait?”



Electricity share of EU final energy demand

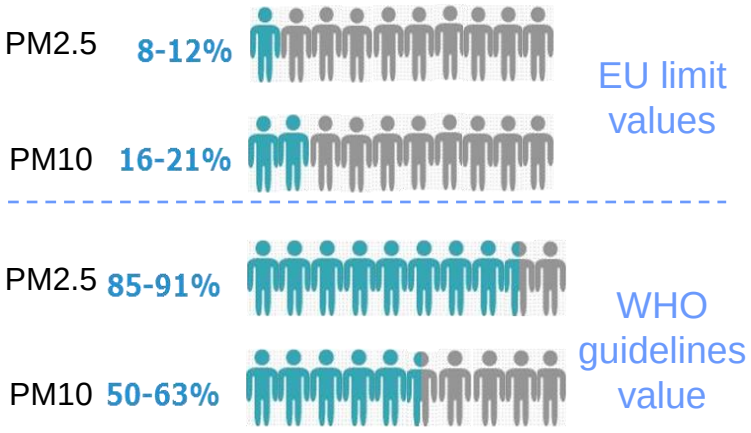
Source: EU Roadmap 2050

Bridging the gaps across policy programs

Upscaling mitigation will require exploiting synergies across different policy areas

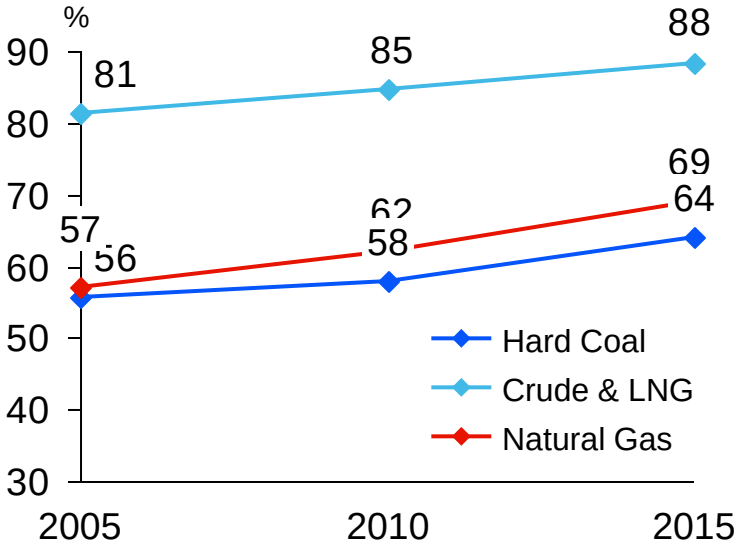
EU28 Air Quality

Urban population exposed to air pollution levels damaging human health (2012-2014)



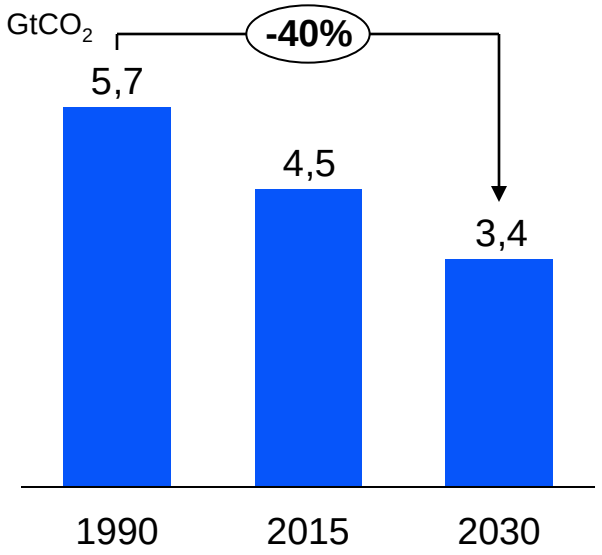
EU28 Security of Supply

Import dependency



EU28 Decarbonization

CO_2 2030 Target



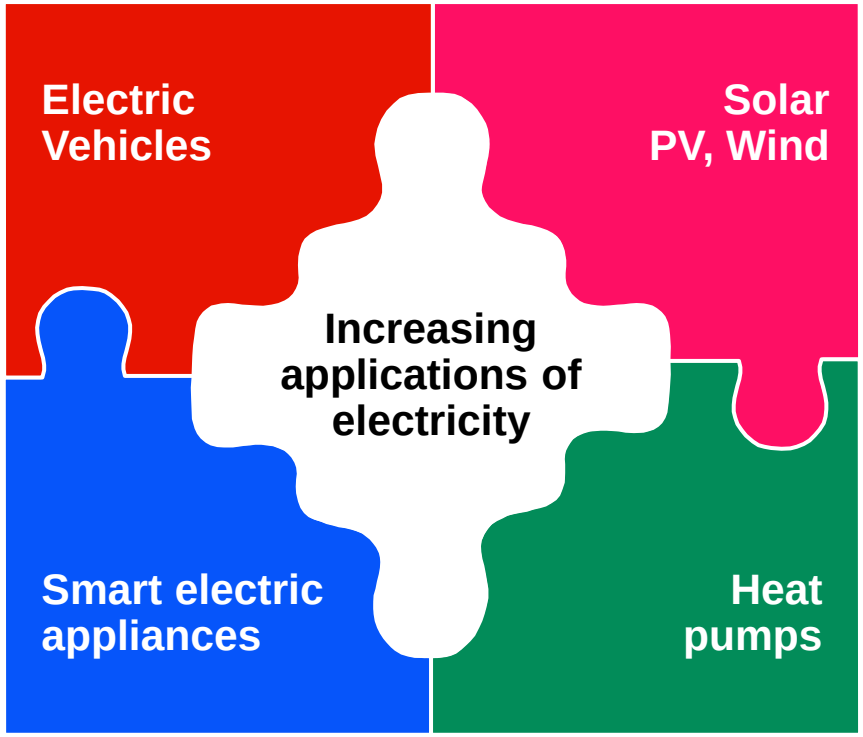
Accelerating electricity penetration will introduce synergies across different policies

Bridging the gaps across industrial sectors

Upscaling deployment will require partnerships spanning across industries

Sample Selection - Not Exhaustive

The Future landscape



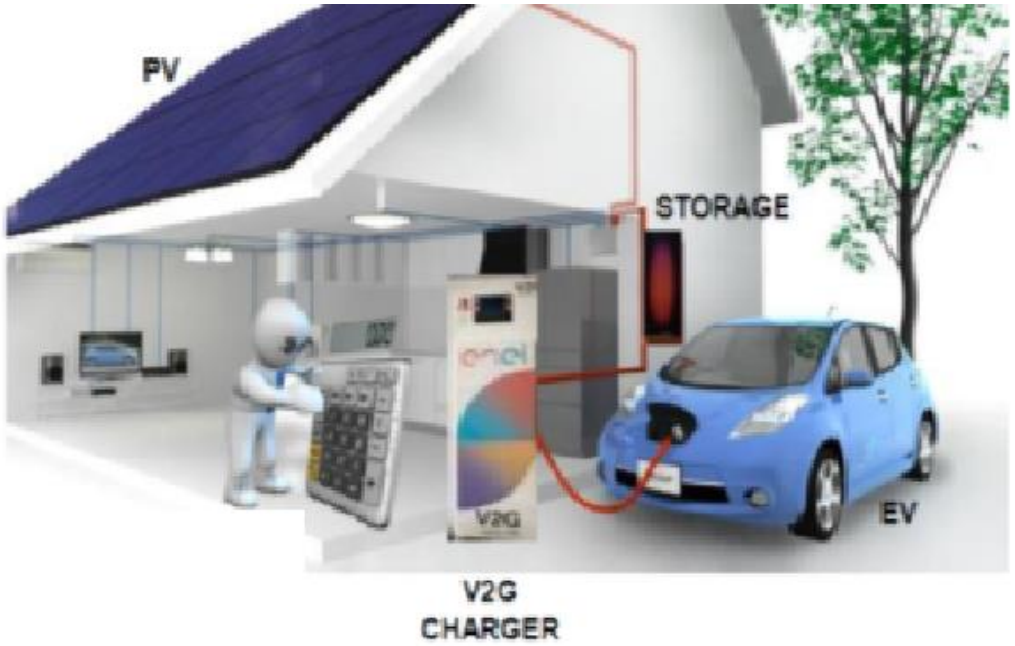
Sector involvement

Electrification application	Sector involved				
	Power	Transpor-tation	Manufac-turing	TLC	ICT
Electric Vehicles	✓	✓	✓	✓	✓
Solar PV, Wind	✓			✓	✓
Smart Electric Appliances	✓		✓	✓	✓
Heat pumps	✓		✓	✓	✓

New ways for the electric industry to experience energy

Interaction between electricity and other industries (e.g. transportation)

Vehicle to Home solutions



Denmark Vehicle to Grid (V2G) Project

Providers

- **Enel** provides V2G chargers (10 kW per each)
- **Nissan** provides electric vehicles
- **Nuvve** provides the V2G aggregation software

Purchaser

- **Energinet.dk** purchases ancillary services

Clients

- **Frederiksberg** Forsyning (danish utility) is the client (10 Nissan ENV-200 + 10 Enel V2G Charger)

Cross-industry partnership to open up new business models

How will the electricity sector look like in 2050?

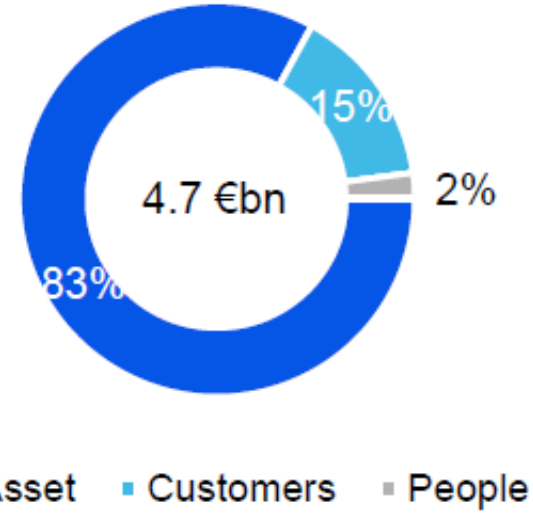
Very very different…

- ✓ **Sustainably Decarbonized** – Generation will be carbon neutral, some fossil fuel may remain behind depending on lock-in effect on conventional generation
- ✓ **Structurally Digitalized** – Digital technology will play a key role in optimizing supply side resources, demand side centers and storage elements
- ✓ **Widely Distributed** – Supply and demand side will be distributed with a level of fragmentation depending on the effectiveness of aggregators
- ✓ **Openly Connected** – The market place will see strong interaction among a much wider variety of players
- ✓ **Dynamically Innovative** – The pace of change and transformation will be high with players testing innovative technologies and business models

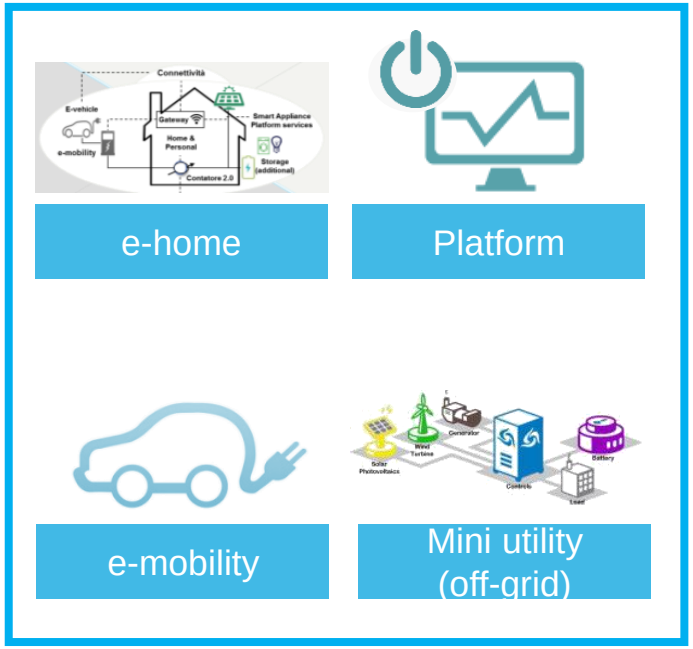
Placing our investments in a rapidly changing world

«Walking the Talk» after «Talking the Walk»

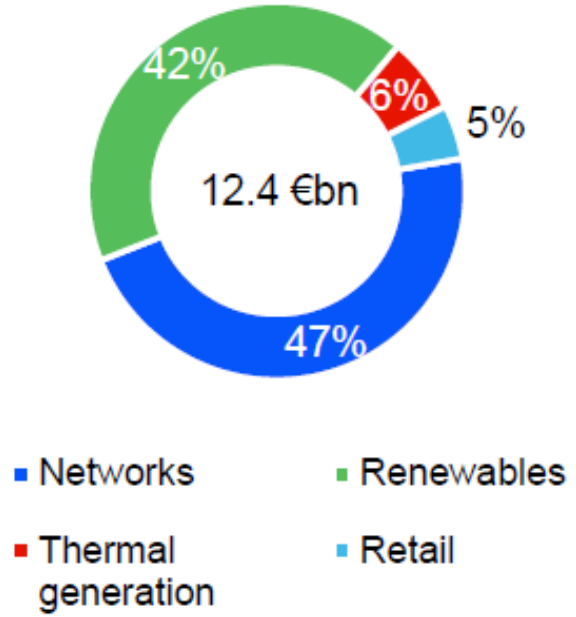
2017-19 cumulative digitalization capex



New E-Solutions Business Line



2017-19 growth capex by business



Source: Enel Group Capital Markets Day – Strategic Plan 2017-19

The need for a new mindset in policy making

Reviewing the current ways of policy making and exploring new ones

On a strategic level:

- Synergies and coordination across policy measures should be sought to achieve a real and f***ull integration of climate, energy and environmental policies*** (especially on air quality)
- To effectively attract investments, Governments should implement ***governance frameworks that ensure regulatory stability and transparency*** of policy delivery

On a more specific level:

- Regulatory frameworks should allow electricity to play its decisive role in the path towards a zero GHG world by ***ensuring a level playing field among energy sources and carriers***.
- ***Development of smart and digitalized infrastructures*** should be promoted in order to integrate environmental-friendly technologies.
- Measures to ***accelerate the uptake of zero emission vehicles should be introduced***, while ensuring the development of publicly and private recharging infrastructure

Concluding remarks

In a world that will change more rapidly than expected

- The Paris Agreement will require ***rapid and drastic decarbonisation*** to fill the ambition gap
- ***Bridging across policy areas and industrial sectors*** will allow for the necessary upscaling and acceleration of mitigation efforts
- The operating and investment ***context for utilities will be changing dramatically***
- Successful utilities will evolve by ***aggressively decarbonizing, decentralizing, digitalizing and becoming openly innovative***