Market design for long term Deep Decarbonisation Pathways: an introduction

CEEM Conference

Group F

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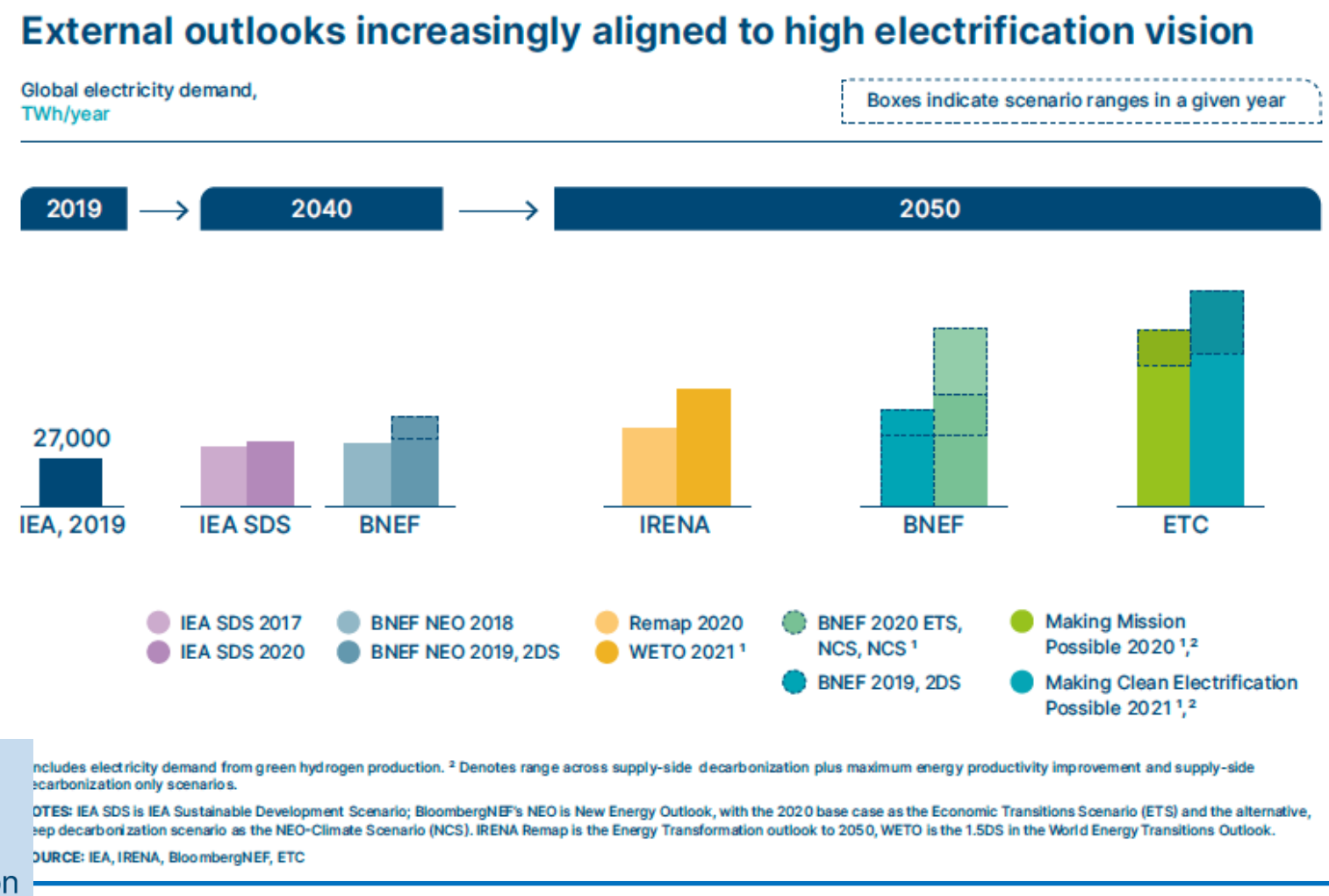
Market design for long term Deep Decarbonisation Pathways:

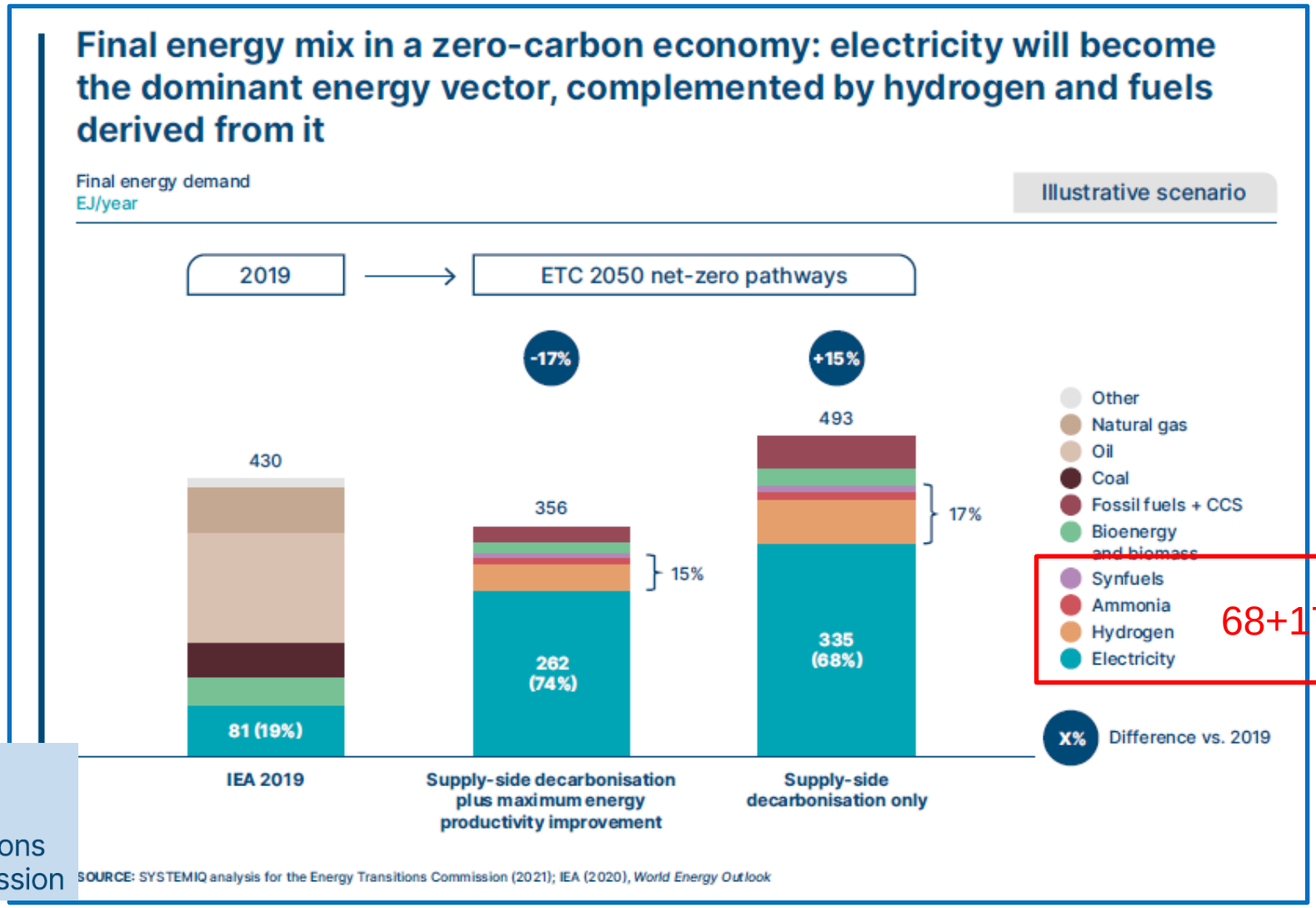
- **The fundamentals of long term 52050 deep decarbonisation scenarios imply:**
  - ⇒ Electrification and a strong increase in final electricity demand and, still more, production (market design 1.0)
  - ⇒ A new balance among final energy carriers electricity, hydrogen, decarbonised methane (bio or CCS)
  - ⇒ Multiple energy carrier couplings (PTX, PTGTP, methanation)
  - ⇒ Energy systems with renewable, storage and hydrogen will turn more decentralized (although not 100% in most case)
  - ⇒ Market design may benefit from the carbon neutrality focal point but will be made difficult by multiple uncertainties (market design 2.0)

Multiplying electricity by 2 to 4 ?



Energy Transitions Commission

A new mix of final energy carriers

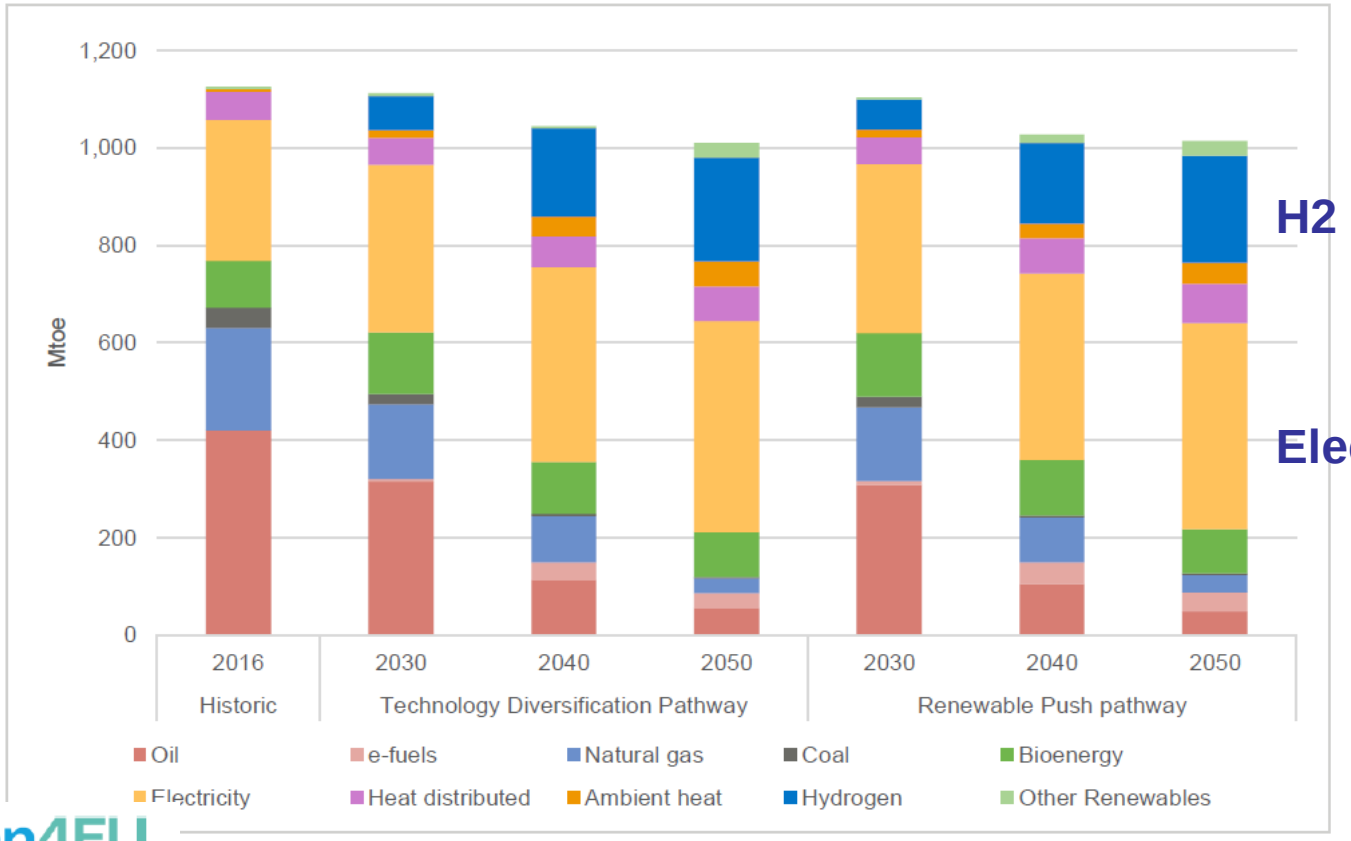


68+17=85%

Energy Transitions Commission

A new mix of final energy carriers

Figure 14. Evolution of gross final energy consumption in the Technology Diversification and Renewable Push pathways, 2016 to 2050

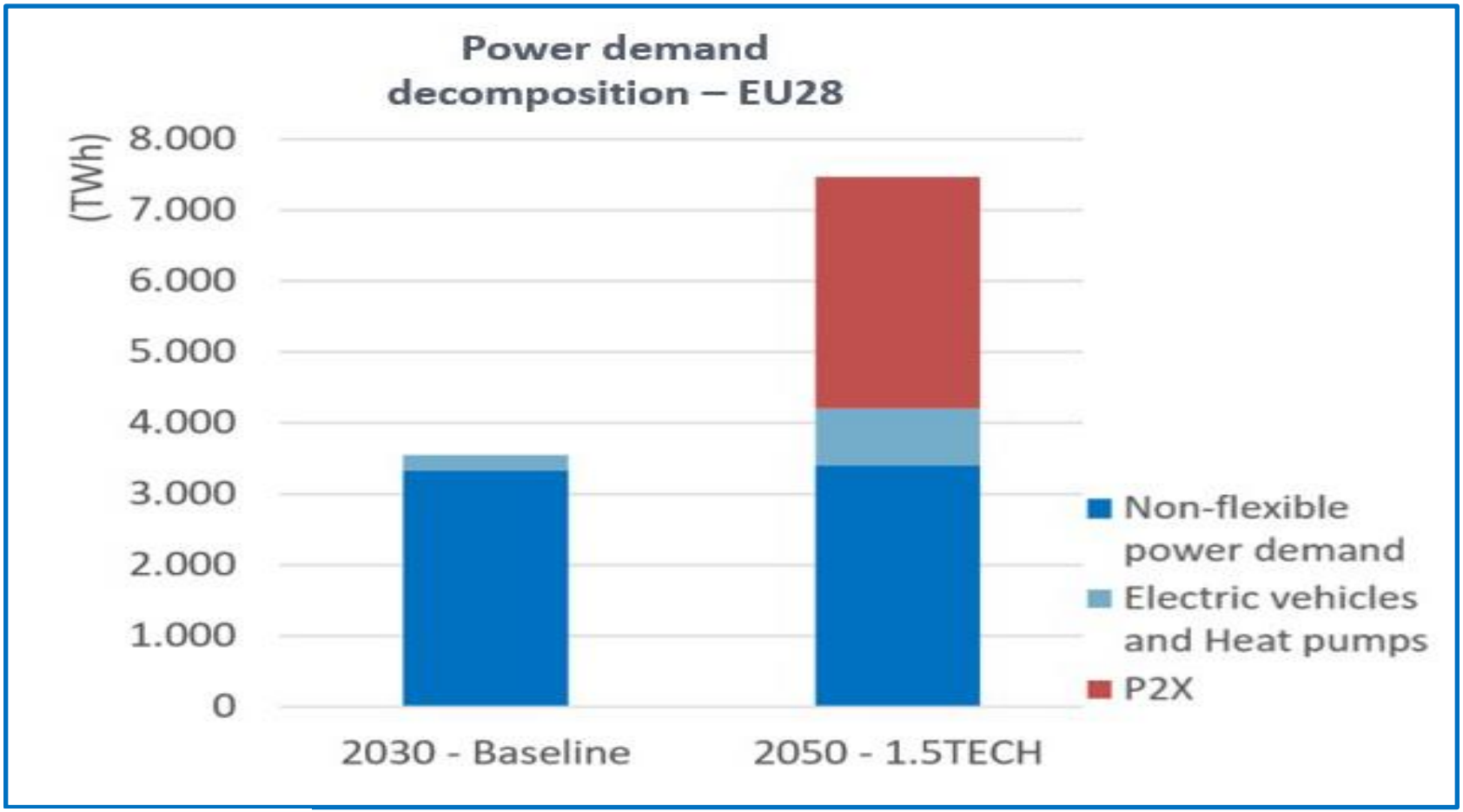


s in final energy consumption correspond to solar and geothermal energy.

Source : *Hydrogen for Europe* study

Hydrogen4EU
CHARTING PATHWAYS TO ENABLE NET ZERO

Up to 40% of PTX ?



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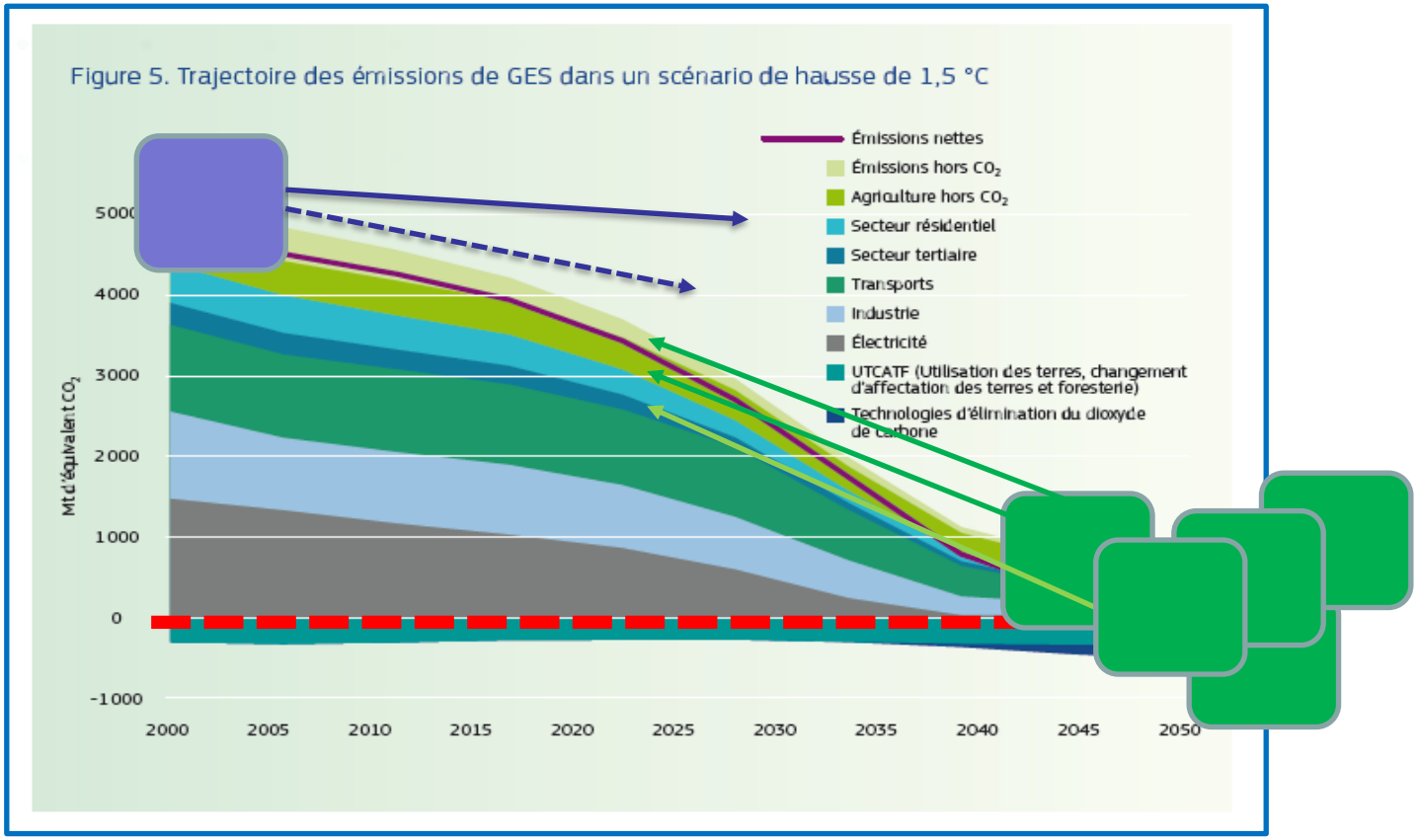
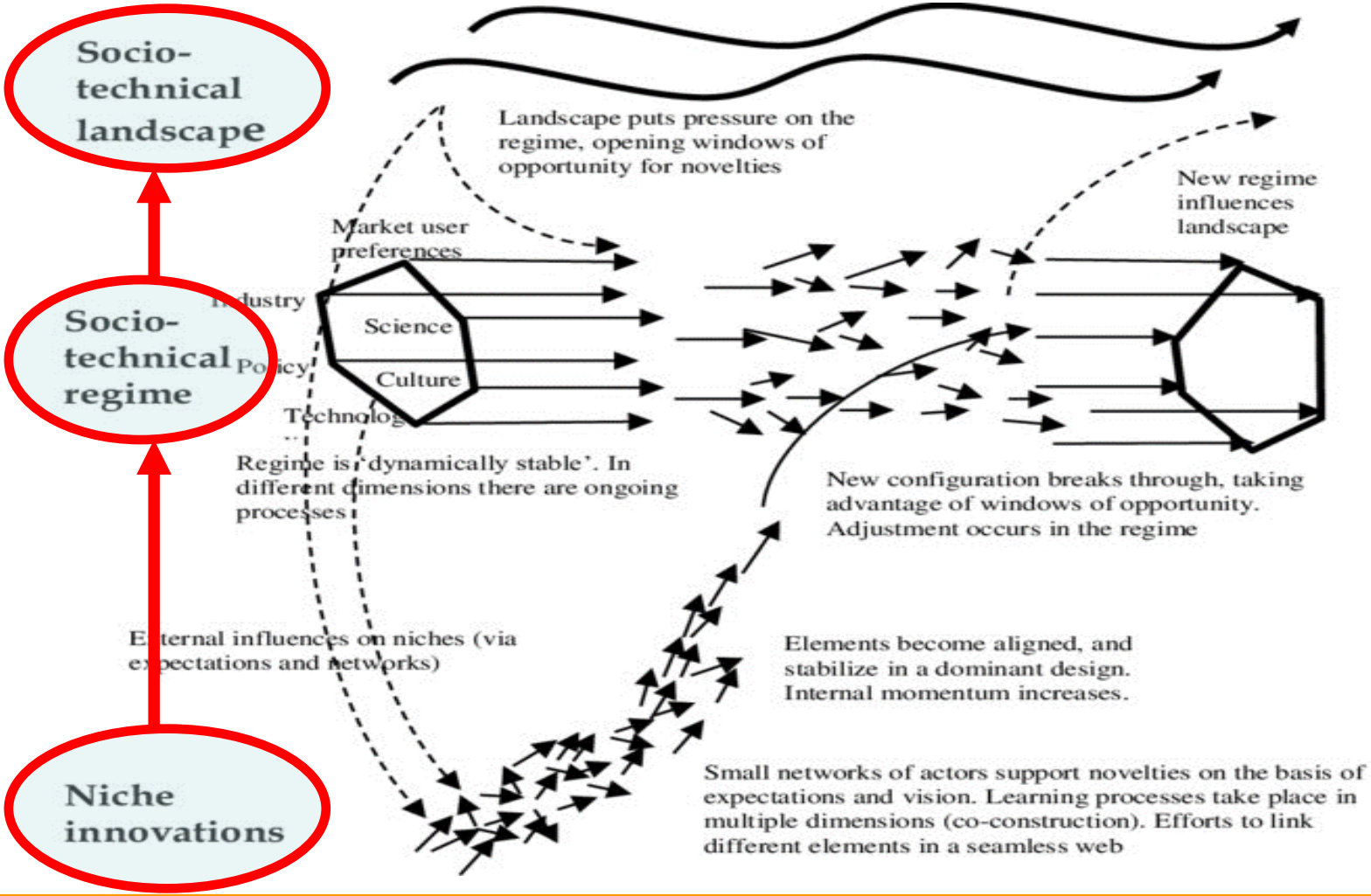
Carbon neutrality: multiple focal points

- Market design for pathways in a forward approach or backward looking (teleology) from Net Zero states ?



Source: ICCS-NTUA, 2018 for EU Commission

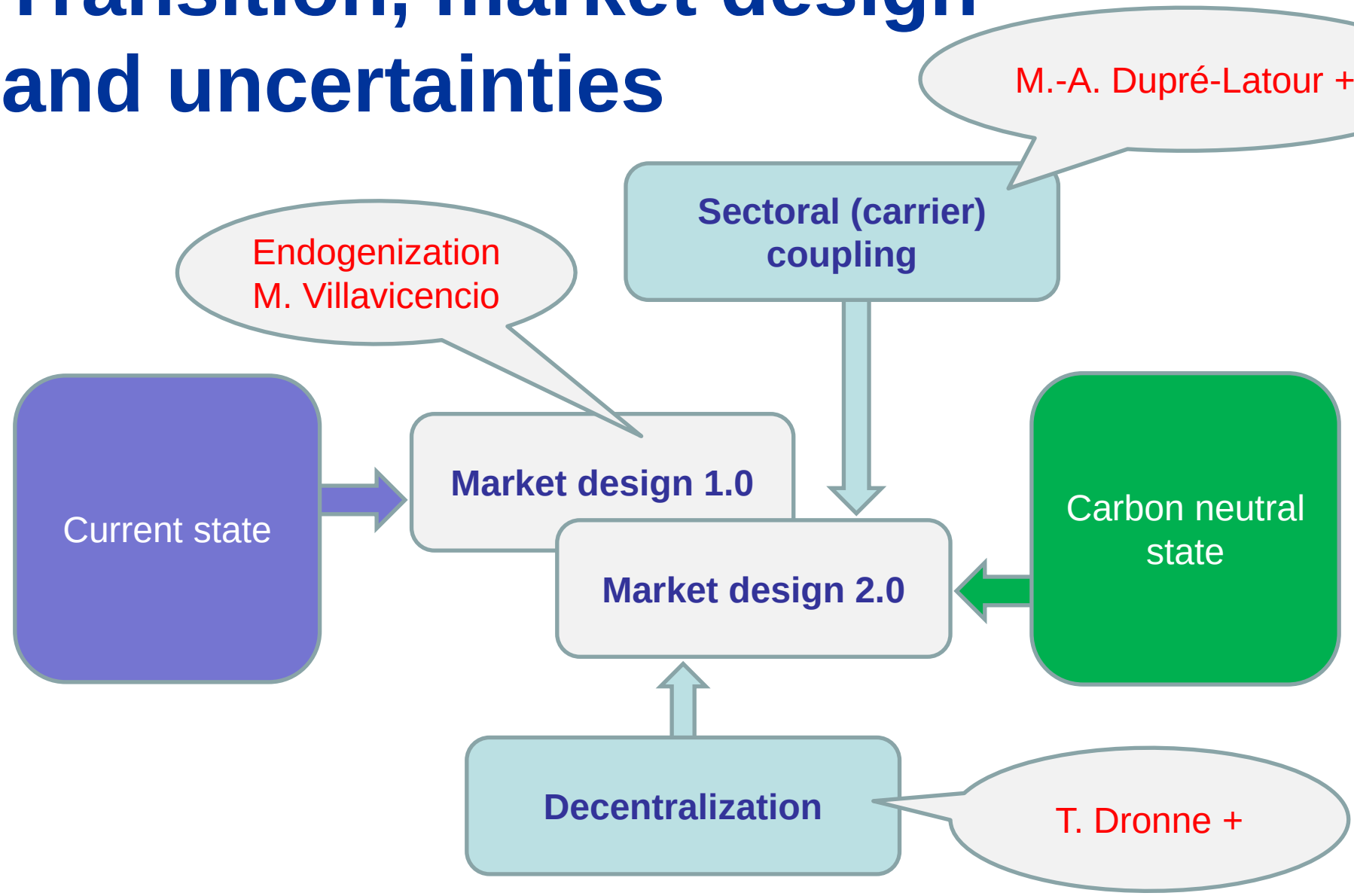
Socio-technical transitions (Geels and Schot, 2007)



Transition, market design and uncertainties

- The management of transitions in the energy socio-technical regime is a challenge for: governments, regulation authorities and utilities
- A key dimension of the problem is the uncertainty on the future of competing but complementary technologies, in a system perspective
- Market design should allow for a fair management of risks in the design and implementation of the Net Zero Emission transition

Transition, market design and uncertainties



Impacts of sector coupling on prices: key issues

- Currently, electricity consumption is almost inflexible. The price is therefore set by production
- In 2050, one can expect a dichotomy for price fixing:
  - either they will be set by renewables, and will then be negative or zero
  - or they will be set by thermal power plants, and be therefore very high.
- This will create major problems for the return on investment
- However, in reality demand will be much more flexible in 2050 than it is today, because of new uses and energy carriers (hydrogen, heat networks…) that can be met or provided either by the electricity sector or by other systems
- As a consequence, flexible consumption will have an increasing impact on price setting. This is a major issue for future research

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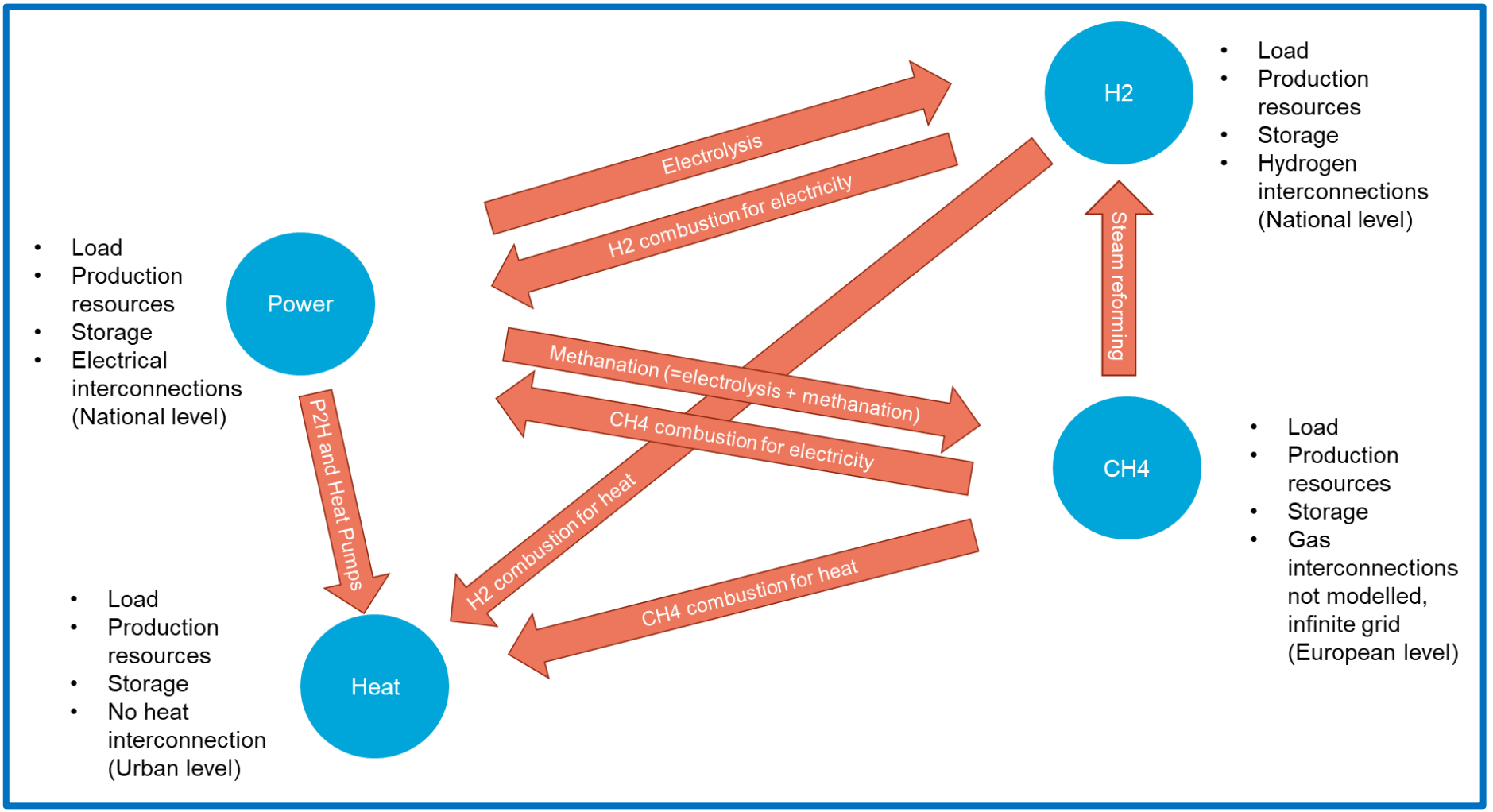
Impacts of sector coupling on prices: methodology



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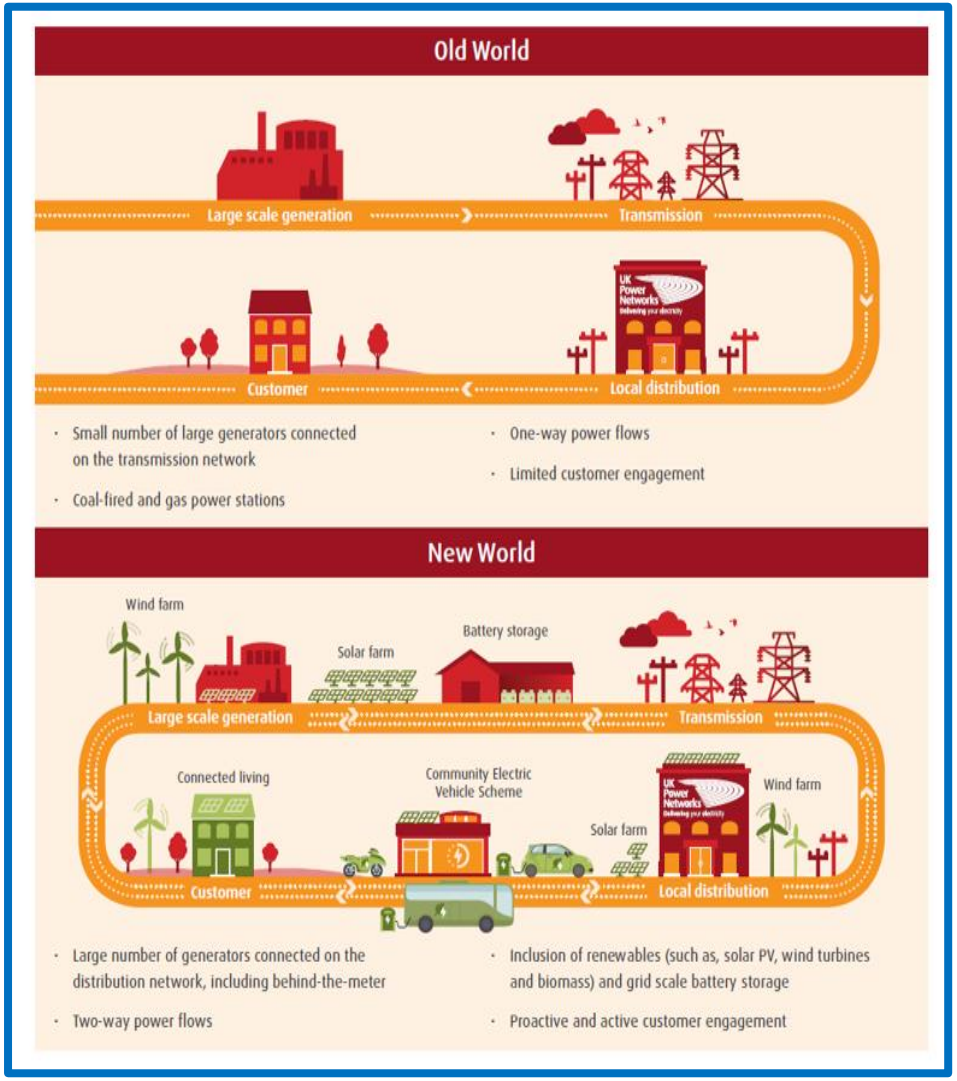
The decentralization of electricity: key issues

- The mains drivers for the decentralization of the electricity systems are:
  - The development of small-size renewable production
  - The changes in end-uses
  - The emergence of decentralized storage facilities

- This involves a growing impact of decisions taken by new smalls actors connected to the distribution network



UKPN, 2018. Flexibility Roadmap.

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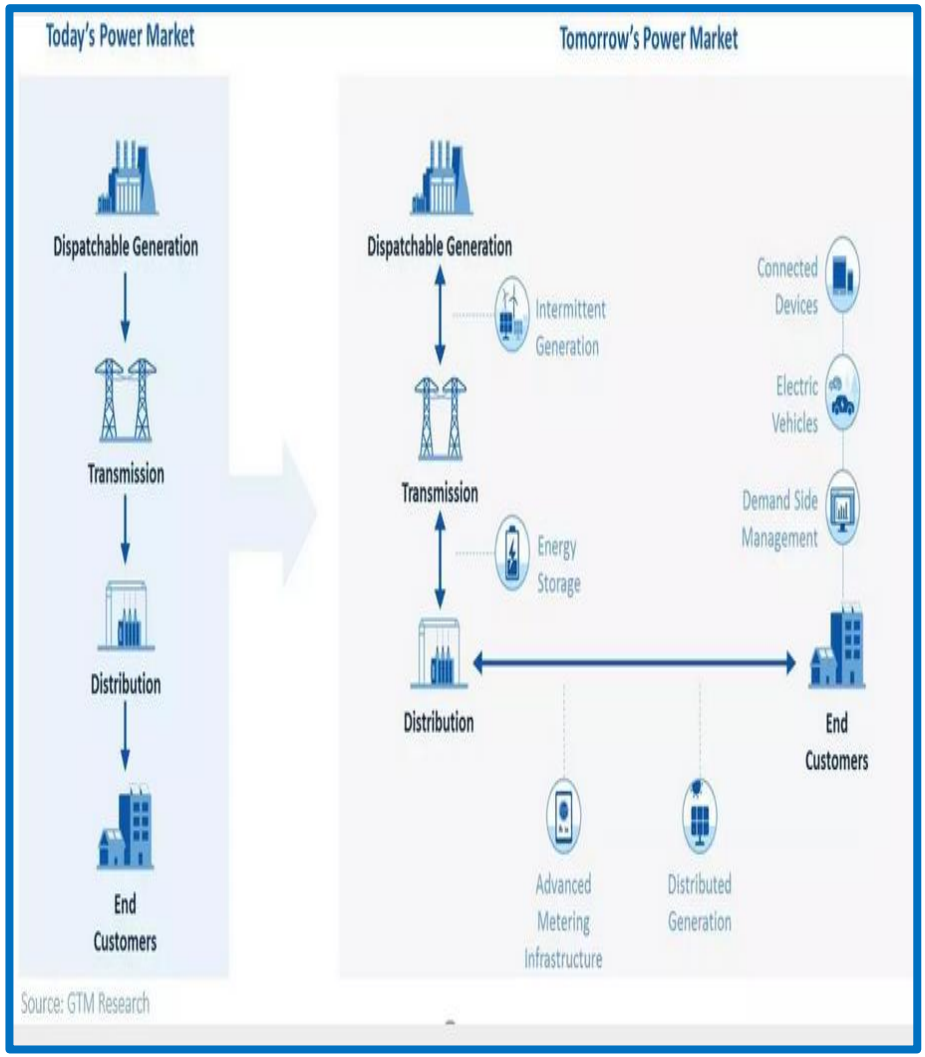
Decentralization : consequences and market-design requirements

- The least-cost integration at of these decentralized resources, requires structural changes in market design:
  - Need to provide local signals for investment and dispatch
  - Need to coordinate and align decisions in a multi-level perspective
  - Need to change the roles and responsibilities of network managers
  - Need to integrate new kinds of available resources



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