Towards a zero-carbon and digital energy system: What policy challenges for Europe?

Our preliminary research results on the issue

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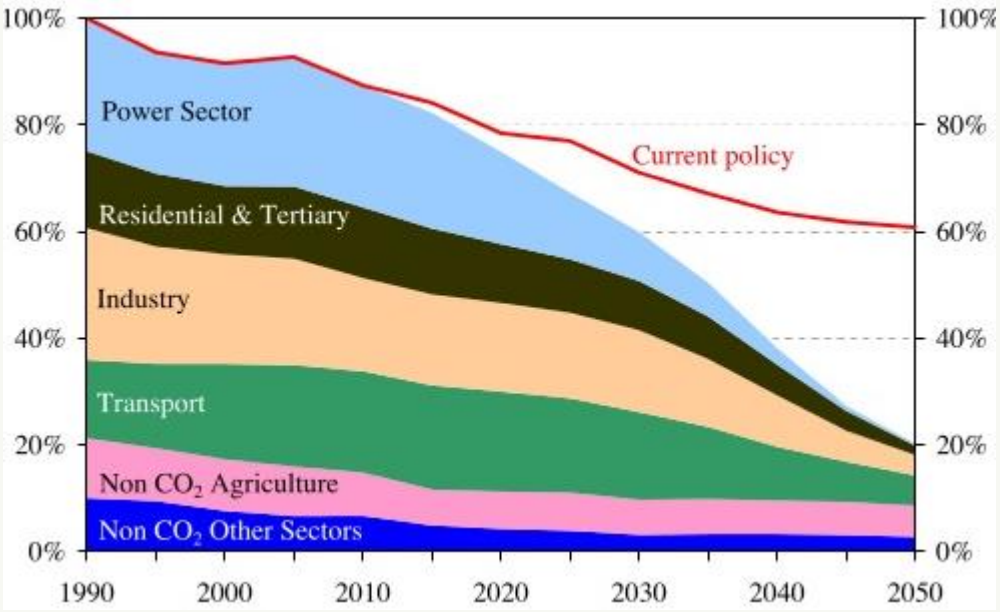
Introduction

EU decarbonisation pathway to 2050

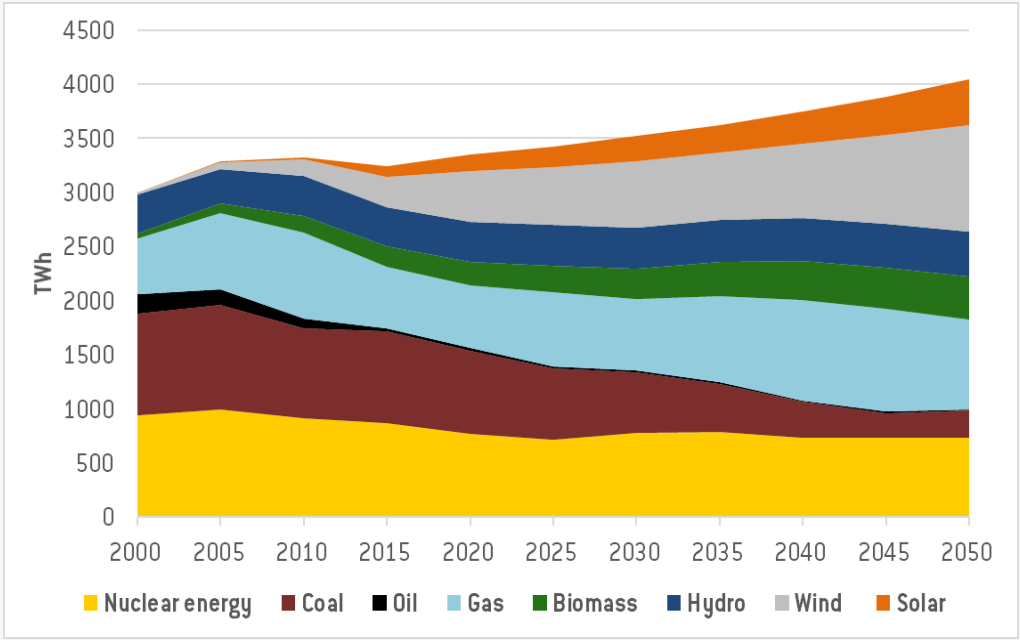


Source: European Commission (2011).

- **Decarbonisation**: cornerstone of EU energy and climate policy
- Long-term **vision**: GHG emissions reduction by **80%-95%** compared to 1990 by **2050**
- Medium-term **binding target**: GHG emissions reduction by **40%** compared to 1990 by **2030**
- **A look at key decarbonisation pathways** in main GHG emitting sectors
- **Outline of key policy challenges**

1.1 - Energy: electricity

EU gross electricity generation by source



Source: Bruegel elaboration on European Commission, EU Reference Scenario 2016.

Decarbonisation options

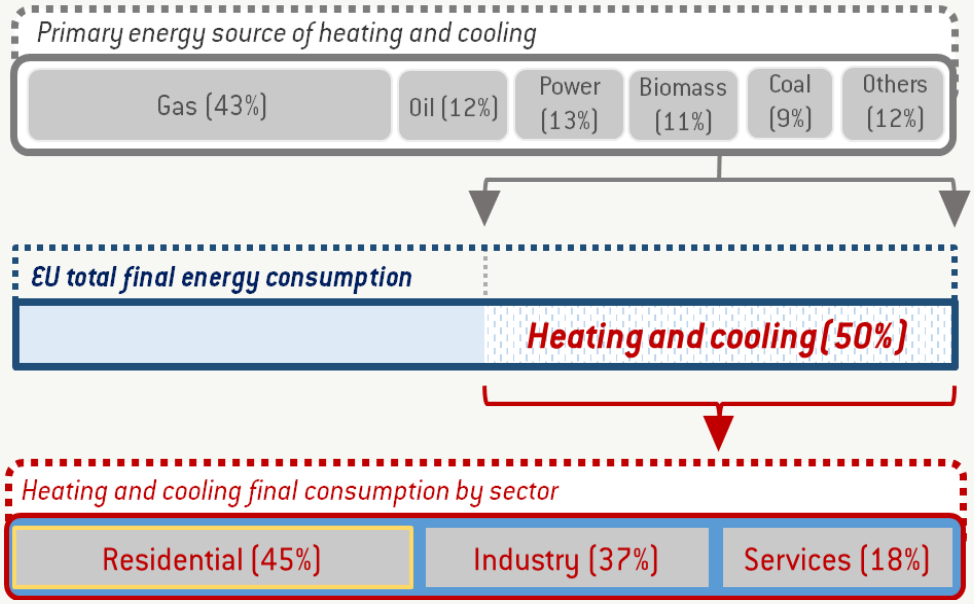
- Energy **efficiency**
- Expand use of **renewables**
- **Carbon capture and storage** (CCS)

Challenges

- Changes in **power system operation, market design** and **generation mix**
- More **flexibility** required to cope with intermittency and non-dispatchability
- Exploit **demand-side management**
- Development of **energy-storage** facilities
- Build **interconnections** between markets

1.2 - Energy: heating and cooling

The crucial role of heating and cooling



Source: Bruegel elaboration on European Commission (2016).

Decarbonisation options

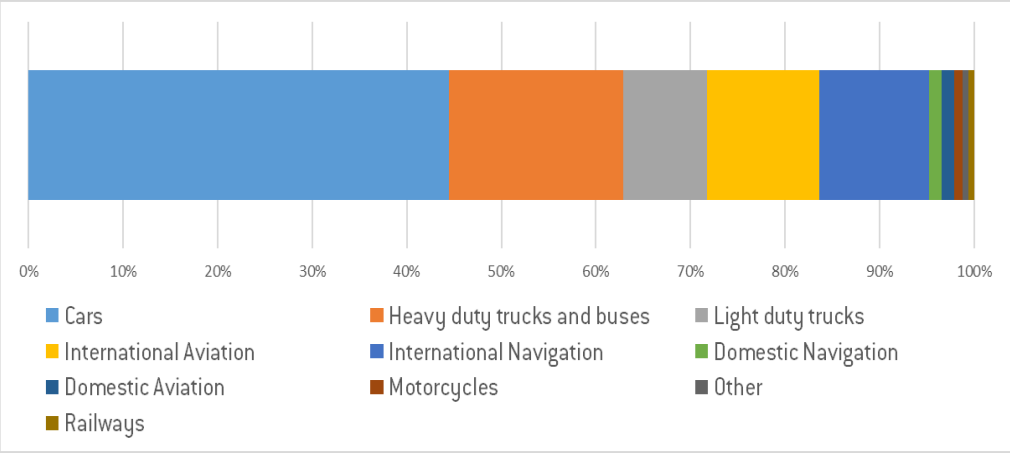
- **Residential & Services**
  - Enhance occupants' **behavior**
  - Improve buildings' **envelope**
  - Enhance efficiency of **H&C supply equipment**
- **Industry**
  - Enhance efficiency of **H&C processes**
  - Recover **waste heat**
  - Enhance efficiency of **H&C equipment**

Challenges

- **Technological lock-in** (e.g. boilers and structural works)
- Highly **fragmented** market
  - H&C produced and consumed **locally**
- Exploit **synergies** between **H&C** and **electricity** sector
  - **Co-generation** of heat and power
  - **District H&C + renewables** via **heat pump**

2 - Transport

EU GHG emissions in the transport sector by category



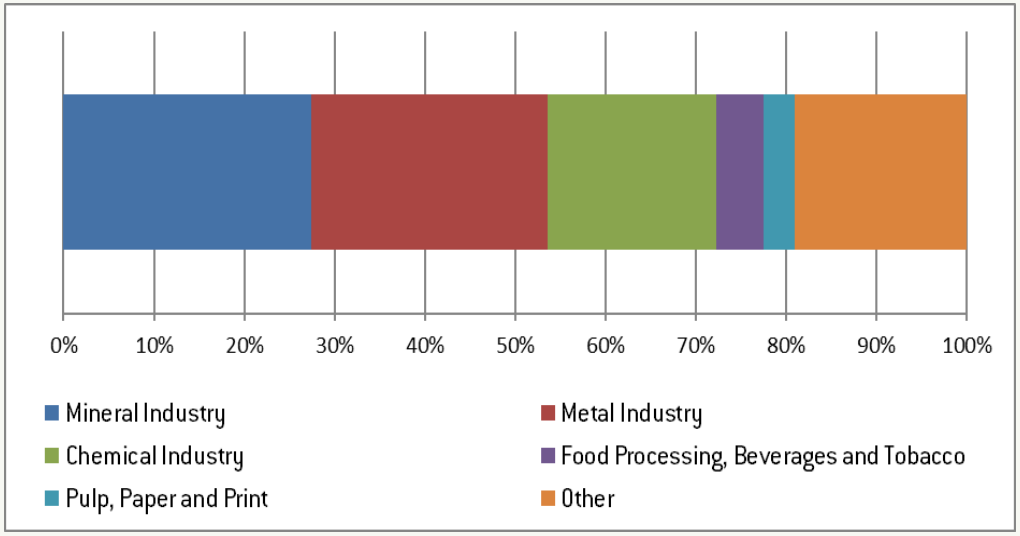
Source: Bruegel elaboration on European Environmental Agency database, accessed in September 2016.

Decarbonisation options & challenges

- **Alternative technologies**: electric, hydrogen and biofuels vehicles
  - Sector relies for 94% on oil
  - **Bottlenecks**:
    - **cost** (upfront investment)
    - **performance** (driving range,…)
    - **infrastructure** (charging stations)
- Mobility's **model shift**
  - Growth of **public transport**
  - **Synergies with car-sharing solutions**
  - **ICT** solutions as enablers
  - Expansion of **pedestrian zones** and **bike sharing**

3 - Industry

EU GHG emissions in the industry sector by category



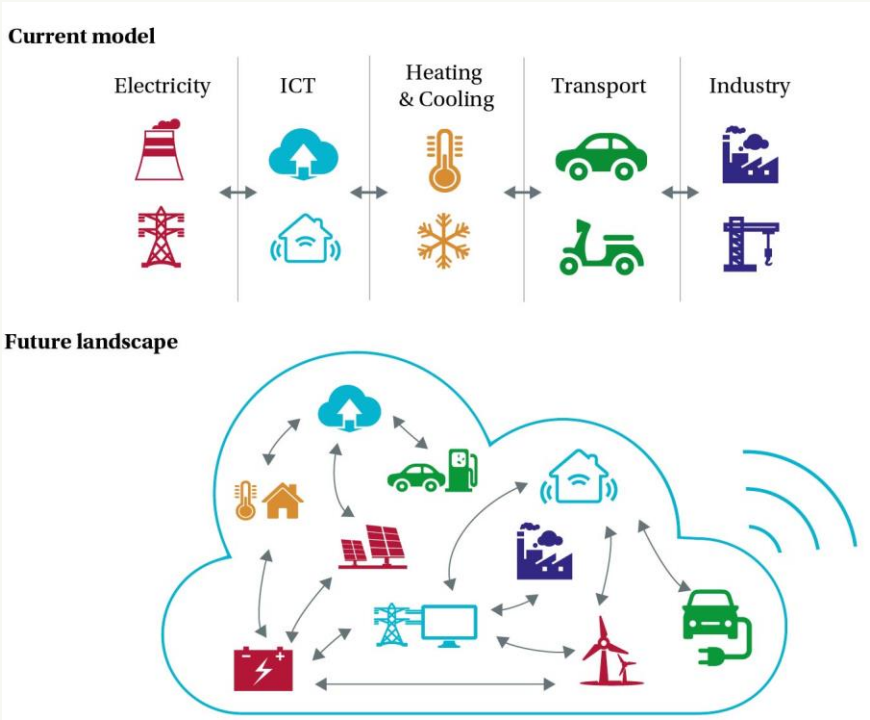
Source: Bruegel elaboration on European Environmental Agency database, accessed in September 2016.

Decarbonisation options & challenges

- Energy **efficiency**
  - **Bottleneck**: right incentives
- **Recovery of waste heat**
  - **Bottleneck**: coordination al local level
- **Carbon capture and storage**
  - **Bottleneck**: lack of business case & infra
- **Biomass**
  - **Replace fossil** as feedstock/fuel (high t)
- **Solar**
  - **Replace fossil** in steam production (low t)
- **Clustering** between industrial sites
  - **Bottleneck**: coordination at local level

Decarbonisation and digitalization: Drivers of a new energy eco-system

Towards a new energy eco-system



Source: Bruegel.

- From a **static & centralized** system to a **dynamic & decentralized** energy eco-system
- **Energy** might transform from **commodity** to **service**

> Electricity, H&C, transport and industry to become **increasingly interconnected**

- ✓ *District heating and cooling, co-generation of heat and power, smart and energy-efficient buildings, balancing role played by electric vehicles, …*

> EU, national and local authorities to **increasingly interact** due to their complementarities

- ✓ *EU and national authorities' role: to set policy frameworks and targets*
- ✓ *Local authorities' role: to act (i.e. to exploit synergies, to put infrastructure in place, …)*

Policy challenge #1:
Managing the increasing sectorial synergies *i/ii*

- **Blurring sectorial boundaries** might pave the way for **emergence of new industrial model**

- **First issue** that needs to be **tackled at EU level** to **facilitate** this transformation:

- ***EU energy market design needs to be rethought***

  - **Products to optimize trans-EU dispatch** of conventional power **less important**
  - **Shorter term products** and **capacity products more important**, but **not harmonized**
  - Need for **new standard products** to be **competitively traded** by **old/new players**
  - **Defining interfaces** for trading and information is **complex**
    (centralization reduces transaction costs, but shifts rents to players in the position to aggregate info…)

Policy challenge #1:
Managing the increasing sectorial synergies *ii/ii*

- **Second issue** that needs to be **tackled at EU/national levels** to **facilitate** this transformation:

- ***European competition, regulatory and fiscal policies need to be modernized***

  - **Convergence of sectors opens fiscal, regulatory, competition policy issues**

  - **Fiscal** policy (e.g. tax on negative externalities?)

  - **Regulatory** policy (e.g. incentives to invest into batteries or charging stations?)

  - **Competition** policy (e.g. complex definition of the "relevant market" for electricity)

  - Fiscal, regulatory, competition policies have to **get up to speed** with the transition

  - If not, they **can create barriers** and **uncertainties** for investors

Policy challenge #2: Managing the increasing role of cities

- **Cities** are the key arenas of decarbonisation (75% of Europeans live in cities)
- **Upsides:**
  - Actions could politically be promoted as ways to enhance local environment
- **Downsides:**
  - Short political cycles + High transaction costs from coordination of parties
- **National + EU levels**: key in setting regulatory frameworks, benchmarks and targets
- **Local authorities**: key in taking concrete actions for decarbonization (eg Copenhagen)
  - **Competences** and **fiscal capacity** of cities might need to be increased
  - **Legislative power** of local authorities might need to be extended
  - **Smarter cities** can generate **positive spill-overs** also for **national/EU levels**

    (Development of **national grids**, **energy security and affordability**, reduced air pollution and traffic congestion with impact on **health care** systems, **job creation** in SMEs, …)

Thank you!