The Challenge Ahead

1. PEAK
2. REDUCTION
3. NEUTRALITY
4. NEGATIVE

Based on data from the Climate Action Tracker (CAT). The data visualization is available at OurWorldInData.org. There you find research and more visualizations on this topic.

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What role for Digital Technologies?

• **[self-evident] Impacts on energy demand and energy efficiency:** digital technologies consume energy. They also improve the efficiency of the energy sector, or provide novel, low-carbon solutions.

• **[not so obvious] Impacts on socio-economic variables:** digital technologies are changing the very foundations of our economies. They will impact competitiveness (e.g. 3D printing and trade); the labour market (e.g. demand for new skills); the ability to access resources and, consequently, the distribution of wealth (e.g. integrated mobility in cities or in peripheral areas), among others.
Digitalization and Energy Demand/Efficiency

- [self-evident] Impacts on energy demand are still poorly known and in some sectors even the sign of the effect is not known and depends on scenarios:
  - **Buildings:** “Network-enabled” appliances might do wonders in making our demands smarted but they will increase need for standby power
  - **Transport:** shared or not? Advanced mobility options (such as integrated mobility) will displace demand for private cars (likely reducing emissions), or displace demand for public transportation (potentially increasing emissions)?
  - **Industry:** Digital technologies (robotization, optimized process controls, 3D printing) can increase energy (and carbon) efficiency of the sector
  - **Energy:** Potential of digital technologies to increase efficiency by integrating demand and supply (prosumers, smart grids, etc)

These aspects are explored by an increasingly rich literature, e.g. the IEA “Energy and Digitalization”, with all its limitations.
Digitalization and Energy Demand/Efficiency
The potential of digital technologies for energy demand and efficiency still strongly depend on their costs.

**Key message:** Technology cost reduction is a key driver enhancing connectivity throughout the electricity sector.

Sources: IEA analysis based on Bloomberg New Energy Finance (2017); Holdowsky et al. (2015); IEA (2017a; 2017b; 2017c); Navigant Research (2017).
Socio-economic impacts of Digitalization

Socio-economic implications and barriers are less understood

• **Industry**: will change the demand for skills (more engineering); may increase competitiveness (e.g. 3D printing as opposed to imports)

• **Buildings**: may be opposed due to privacy concerns. “Digital poverty” leads to marginalization (class-B citizens)

• **Transportation**: “mobility” is best suited for densely populated areas as opposed to peripheral areas. Digitalization may push some users “off-the-market”.
Digitalization will have a huge mediating effect on decarbonization

Mutually enhancing? Sustainable future?

A “perfect storm”? Hotter and more unequal world?
Emissions

Socio-economic impacts

Digitalization

Decarbonization

Understanding how to manage these challenges so that they are mutually enhancing is a crucial research question.
What are we missing?

- DATA on socio-economic impacts of digitalization
- METHOD to link digitalization and decarbonization
- POLICIES for decarbonization through digitalization
2D4D closes these gaps for 3 highly disruptive technologies in 3 hard-to-decarbonize sectors.
What is the idea behind 2D4D?

- Additive manufacturing
- Mobility as a Service
- Ambient Intelligence

Integrated Assessment Model
- Industry model
- Mobility model
- Buildings model

Decarbonization narratives

Data collection and analysis

Enhanced narratives Modelling

Policy portfolios

Policy design and evaluation

Frontier Research Approach

Broad toolkit of complementary methods:
Qualitative Comparative Analysis, Econometrics, Big Data Analytics, Expert Elicitations, Modelling, etc.
<table>
<thead>
<tr>
<th>2D4D Outcomes</th>
<th>2D4D Impacts</th>
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<tbody>
<tr>
<td><strong>New data and knowledge</strong></td>
<td><strong>Scholars</strong></td>
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<tr>
<td>Re: technical and socio-economic impacts</td>
<td>- Academics (economics, social sciences,</td>
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<tr>
<td>of digitalization (by sector and</td>
<td>environment, engineering, business, law)</td>
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<td>geographically differentiated)</td>
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<td><strong>New modelling methods</strong></td>
<td><strong>Intl organizations</strong></td>
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<td>(1) Enriched decarbonization narratives</td>
<td>- IPCC, World Bank, G20, B20, T20</td>
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<td>(2) Sectoral and integrated models</td>
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<td><strong>No-regret policy portfolios</strong></td>
<td><strong>Policy Makers</strong></td>
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<td>and identification of trade-offs</td>
<td>- Local, national, supra-national level</td>
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<td></td>
<td><strong>Private actors</strong></td>
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<td></td>
<td>- Industrial stakeholders, labor unions,</td>
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<td></td>
<td>transportation agencies, construction firms,</td>
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<td>civil society, students, SMEs</td>
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2D4D

Disruptive Digitalization For Decarbonization

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