Energy Technology Perspectives 2017
Catalysing Energy Technology Transformations

Dave Turk, Acting Director, Directorate of Sustainability, Technology and Outlooks, IEA

Innovation for Cool Earth Forum (ICEF) - Side Event
October 2017, Tokyo, Japan
Introduction

- Accelerating technological progress strengthens economies, energy security and sustainability
- Policies and RD&D drive down costs and improve performance
- Clean energy technologies are progressing, but few on track
- Need to focus on all technologies; lack of progress on some puts even more pressure on others
- IEA’s new work on digitalization and energy brings new insights in understanding the role of technologies and innovation
Key points of orientation

- **Global energy markets are changing rapidly**
  - Renewables supplied half of global electricity demand growth in 2016, and increase in nuclear capacity reached highest level since 1993
  - Global energy intensity improved by 2.1% in 2016
  - Electric car sales were up 40% in 2016, a new record year

- **The energy sector remains key to sustainable economic growth**
  - 1.2B people lack access to electricity; 2.7B people lack access to clean cooking
  - Largest source of GHG emissions today, around two-thirds of global total
  - Largest source of air pollution, linked to 6.5 million premature deaths per year

- **There is no single story about the future of global energy**
  - Fast-paced technological progress and changing energy business models
IEA analysis shows that global CO₂ emissions remained flat in 2016 for the third year in a row, even though the global economy grew, led by emission declines in the US and China.
How far can technology take us?

Pushing energy technology to achieve carbon neutrality by 2060 could meet the mid-point of the range of ambitions expressed in Paris.

Technology area contribution to global cumulative CO₂ reductions

Global CO₂ reductions by technology area

GT CO₂ cumulative reductions in 2060

- Efficiency 40%
- Renewables 35%
- Fuel switching 5%
- Nuclear 6%
- CCS 14%

2 degrees Scenario – 2DS

Beyond 2 degrees Scenario – B2DS

Reference Technology Scenario – RTS

Global CO₂ reductions for 2DS and B2DS scenarios.

© OECD/IEA 2017
Recent progress in some clean energy areas is promising, but many technologies still need a strong push to achieve their full potential and deliver a sustainable energy future.
Systems Integration is essential for a sustainable energy future

We need to move away from a one-directional energy delivery philosophy
We need to move away from a one-directional energy delivery philosophy to a digitally-enhanced, multidirectional and integrated system that requires long-term planning for services delivery.
The value of storage is starting to drive new solutions

Globally installed non-pumped hydro electricity storage (GW)

Globally installed electricity storage (GW)

Positive market and policy trends supported a year-on-year growth of over 50% for non-pumped hydro storage. But near-term storage needs will remain largely answered by existing or planned pumped hydro capacity.
Can we change the landscape of transport?

The transportation sector already experiences technological change, but won’t shed its oil dependency without assertive policies.
Enhanced buildings efficiency could also improve system flexibility

Energy use in the buildings sector under different scenarios

- **2014 (123 EJ)**
  - Electricity: 31%
- **RTS 2060 (157 EJ)**
  - Electricity: 54%
- **B2DS 2060 (112 EJ)**
  - Electricity: 61%

Efficiency technologies can provide the same level of comfort while reducing energy demand despite doubling floor area.
We need to produce materials more sustainably

Effective policies and public-private collaboration are needed to enable an extensive roll-out of energy and material efficiency strategies as well as a suite of innovative technologies.
A challenging task ahead for CCS

CCS is happening today, but needs to be ramped up hundreds of times to achieve long-term goals. The role for CCS varies based on local circumstances.
Global clean energy RD&D spending needs a strong boost

Global RD&D spending in efficiency, renewables, nuclear and CCS plateaued at $26 billion annually, coming mostly from governments. Mission Innovation could provide a much needed boost.
Conclusions of the ETP 2017

- Early signs point to changes in energy trajectories, helped by policies and technologies, but progress is too slow
- An integrated systems approach considering all technology options must be implemented now to accelerate progress
- Each country should define its own transition path and scale-up its RD&D and deployment support accordingly
- Achieving carbon neutrality by 2060 would require unprecedented technology policies and investments
- Innovation can deliver, but policies must consider the full technology cycle, and collaborative approaches can help
IEA Efforts on Digitalization and Energy

- **“Digitalization”** is the increasing application of information and communications technology (ICT) to the physical world – i.e., blurring/convergence of the “digital” and physical worlds.  
  \[ \text{Digital world} = \text{data} + \text{connectivity} + \text{analytics} \]

- **IEA digitalization work for many years**

- **Growing interest** for IEA Secretariat to focus more on digitalization by IEA Members, companies, etc.

- While interest on digitalization is wide, **current understanding** of the scale and scope of potential impacts is limited, particularly *quantitative and analytically-rigorous assessments*

- **Cross-IEA Digitalization & Energy Working Group** consisting of multiple IEA divisions; several new and enhanced streams of work

© OECD/IEA 2017
Digitalization trends: Exponential growth in data

- 90% of data in the world today were created over past two years (IBM)

Digitalization trends: Growing connectivity

47% of global population (3.5 b) are now using the Internet, up from only 8% (500 m) in 2001 (ITU, 2017)

Sources: ITU (2017) ICT Indicators database; IEA (2016) WEO Energy Access database. Note: Developed/developing country classifications are based on the UN M49
An assessment of the implications of digitalization on the energy sector, bringing together new quantitative assessments, qualitative insights, and analysis of policy implications

- **Current intersection of digital and energy**

- **Sector-by-sector trends and impacts**
  - Demand (industry, transport, and buildings)
  - Supply (e.g., oil & gas); electricity generation performance impacts (avoided investments)
  - Digital technologies

- ** Longer-term, systemic impacts**
  - Smart energy systems: connectivity in the power sector as an enabler for flexibility, demand side management, integration of variable renewables, peer-to-peer energy transactions, new business models

- **Challenges and opportunities for policy-makers**
  - Digital resilience, privacy, economic disruption
  - No-regrets policy recommendations

*With real-world examples highlighting policy goals that digitalization can help achieve*
Digitalization of the power sector

Current structure of electricity sector – digitalization of silos

Digitalization – especially connectivity – can fundamentally re-shape the electricity sector

Electricity system integration through digitally-enabled connectivity
Explore the data behind ETP

www.iea.org/etp

www.iea.org

@IEA

www.iea.org/statistics