

## Energy Technology Perspectives 2017 Catalysing Energy Technology Transformations

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## **Scenarios and Modelling**

• Where do we need to go?

## **Statistics and trends**

• Where are we today?

# **Technology Roadmaps**

• How do we get there?







Technology Roadmap Hydrogen and had Calls



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#### Global CO<sub>2</sub> emissions flat for 3 years – an emerging trend?







IEA analysis shows that global CO<sub>2</sub> 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.



Technology area contribution to global cumulative CO<sub>2</sub> reductions

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

Gt CO<sub>2</sub> cumulative reductions in 2060

#### The potential of clean energy technology remains under-utilised





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.

## IEA energy modelling and scenarios





 Forecasts (next 5 years) : Medium-term Market Reports

- ENERGY EFFECIENCY Market Report
- Market-based scenarios (out to 2040): World Energy Outlook
- Long-term planning scenarios (out to 2060): Energy Technology Perspectives

System Integration: Analysis of flexibility resources/market design for vRE





## ETP modelling framework



- Four soft-linked models based on simulation and optimisation modelling methodologies
- Model horizon: 2014-2060 in 5 year periods
- World divided in 28-42 model regions/countries depending on sector
- For power sector linkage with TIMES dispatch model for selected regions to analyse electricity system flexibility

#### Decarbonising electricity



Renewables dominate electricity generation in the 2DS and B2DS. Thanks to bioenergy with CCS, the average global CO<sub>2</sub> intensity falls below zero after 2050.

#### Systems Integration is essential for a sustainable energy future



We need to move away from a one-directional energy delivery philosophy

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## Spatial analysis of renewable potentials: Example onshore wind



Analysis of onshore wind potential



• Onshore wind potential differentiated by capacity factor, distance to cities and population size



### Spatial analysis of renewable potentials: Onshore wind in China









The transportation sector already experiences technological change, but won't shed its oil dependency without assertive policies.

## Optimising the use of sustainable biomass





Around 145 EJ of sustainable bioenergy is available by 2060 in IEA decarbonisation scenarios, but gets used differently between the 2DS and the B2DS.

### Conclusions

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- 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 scaleup 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

## Explore the data behind ETP





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