Energy Perspectives 2016
Long-term macro and market outlook
Columbia University, 16 November 2016
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Macro and market outlook to 2040 – www.statoil.com/energyperspectives
The triple energy challenge – a balancing act

Satisfying demand
- Population growth
- GDP growth
- Increasing energy demand
- Fighting decline from existing fields

Risk/reward balance
- Price uncertainty
- Cost challenges
- Risk elements
- Policy uncertainty

Sustainability
- Clean and affordable energy for all
- Limiting greenhouse gas emissions
- Policy gap between targets and measures
Significant uncertainty and large changes
... this calls for using scenarios

Source: The Economist
Source: DOE, CEIC, IEA, IRENA
Several futures are possible…
Rivalry, Reform, Renewal* - but the world is twice as rich and more efficient

Source: IEA (history), Statoil (projections)

*Rivalry: Geopolitical uncertainty, regional conflicts; Reform: COP21 followed up and tightened; Renewal: Energy revolution delivering emissions consistent with 2°C target
A strong trend affecting economics and energy
All growth in energy demand in emerging economies, in particular in Asia

The global population centre is in Asia
Each small square represents 1 million people

World energy demand per region
Bn toe

- Rest of world
- India
- China
- OECD Pacific
- OECD Europe
- OECD Americas

Source: BigThink, IEA, Statoil (projections)
Speeding up the change in global energy mix
… with Renewal displaying a paradigm shift

Source: IEA (history), Statoil (projections)
OECD Americas energy mix changes gradually

... but Renewal displays a paradigm shift
**CO\textsubscript{2} emissions determined by demand and mix**

Climate policies: Driving Renewal, contributing to Reform

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**World CO\textsubscript{2} emissions**

Billion tons

- **2013**
  - Rivalry
  - Reform
  - Renewal

- **2040**
  - NP
  - 450

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Source: IEA (history), Statoil (projections)
Technology shift for light duty vehicles

... in all scenarios, and a revolution in Renewal

Source: IEA (history), Statoil (projections)
Technology changes in LDVs in OECD Americas

... and revolution in Renewal

Source: IEA (history), Statoil (projections)
Fuel mix change in electricity
Large investments in new renewables required, especially in Renewal

**Electricity generation mix**

- **2013**
  - Geothermal (Ref, Ren, Riv)
  - Biomass (Ref, Ren, Riv)
  - Solar (Ref, Ren, Riv)
  - Hydro (Ref, Ren, Riv)
  - Wind (Ref, Ren, Riv)
  - Nuclear (Ref, Ren, Riv)
  - Oil (Ref, Ren, Riv)
  - Gas (Ref, Ren, Riv)
  - Coal (Ref, Ren, Riv)

- **2040**
  - Geothermal (Ref, Ren, Riv)
  - Biomass (Ref, Ren, Riv)
  - Solar (Ref, Ren, Riv)
  - Hydro (Ref, Ren, Riv)
  - Wind (Ref, Ren, Riv)
  - Nuclear (Ref, Ren, Riv)
  - Oil (Ref, Ren, Riv)
  - Gas (Ref, Ren, Riv)
  - Coal (Ref, Ren, Riv)

**Solar and wind generation capacity**

- **2013**
  - Solar (Ref, Ren, Riv)
  - Wind (Ref, Ren, Riv)

- **2040**
  - Solar (Ref, Ren, Riv)
  - Wind (Ref, Ren, Riv)
De-carbonization of power in OECD Americas

...will require large investments in new renewables

![Electricity generation mix graph]

- **2013**
  - Ref: [Graph showing energy sources]
  - Ren: [Graph showing energy sources]
  - Riv: [Graph showing energy sources]

![Solar and wind generation capacity graph]

- **2013**
  - Ref: [Graph showing solar and wind]
  - Ren: [Graph showing solar and wind]
  - Riv: [Graph showing solar and wind]

- **2040**
  - Ref: [Graph showing solar and wind]
  - Ren: [Graph showing solar and wind]
  - Riv: [Graph showing solar and wind]
Other sectors are more challenging to change … and demand here will grow as the economy grows…

Fuel mix in Final Energy Demand for Transport excluding LDVs
Bn toe
- Coal
- Oil
- Gas
- Biomass
- Electricity

Fuel mix in Final Energy Demand for Residential, Commercial & Industrial sectors
Bn toe
- Coal
- Oil
- Gas
- Biomass
- New RES
- Electricity
- Heat

Source: IEA (history), Statoil (projections)
Global oil and gas demand growth varies
Large variation across sectors – significant growth in non-energy demand

Source: IEA (history), Statoil (projections)
North American oil demand will decrease
...despite growth in non-energy demand

Source: IEA (history), Statoil (projections)
Huge investments needed in oil, gas and renewable electricity … to replace production and ensure sustainability
Wide span in forecasts

Source: Statoil, IEA (WEO 2015), EIA, BP, ExxonMobil
There’s never been a better time for good ideas

Thank you!

www.statoil.com/energyperspectives