World Energy Scenarios

THE GRAND TRANSITION

APERC Annual Conference 2017

Christoph Menzel | 16th May 2017 | Tokyo - Japan
World Energy Scenarios

Modern Jazz

Unfinished Symphony

Hard Rock
## Pre-determined Elements of the Grand Transition

<table>
<thead>
<tr>
<th>Factors shaped world energy 1970 - 2015</th>
<th>Pre-determined elements 2015 - 2060</th>
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<tbody>
<tr>
<td><strong>Population / Workforce</strong></td>
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<tr>
<td>▪ Global population grew 2x (1.7% p.a.)</td>
<td>▪ Global population will grow 1.4x (0.7% p.a.)</td>
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<tr>
<td><strong>New Technologies</strong></td>
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<tr>
<td>▪ ICT revolution</td>
<td>▪ Pervasive digitalisation; combinatorial impacts and productivity paradox</td>
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<td>▪ Productivity growth rate of 1.7% p.a.</td>
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<td><strong>Planetary Boundaries</strong></td>
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<td>▪ 1,900+ Gt CO$_2$ consumed</td>
<td>▪ 1,000 Gt CO$_2$ consumed to 2100 for the 2°C target</td>
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<td><strong>Shifts in Power</strong></td>
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<td>▪ Rapid economic rise of developing nations</td>
<td>▪ 2030: India is most populous country</td>
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<tr>
<td>▪ Growing role for global institutions, e.g. UNFCCC, IMF, WTO, G20</td>
<td>▪ 2035-45: China is the world’s largest economy</td>
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Three Scenarios

**Modern Jazz**
- Market-driven approach to achieving individual access and affordability of energy through economic growth
- Market mechanisms
- Technology innovation
- Energy access for all

**Unfinished Symphony**
- Government-driven approach to achieving sustainability through internationally coordinated politics and practices
- Strong policy
- Long-term planning
- Unified climate action

**Hard Rock**
- Fragmented approach driven by desire for energy security in a world with low global cooperation
- Fragmented policies
- Local content
- Best-fit local solutions
Implications for Energy Sector
THE WORLD’S PRIMARY ENERGY DEMAND GROWTH

... will slow and per capita energy demand will peak before 2030 due to unprecedented efficiencies created by new technologies and more stringent energy policies.

Slower Primary Energy Demand Growth

Per Capita Primary Energy Demand

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DEMAND FOR ELECTRICITY

... will double to 2060. Meeting this demand with cleaner energy sources will require substantial infrastructure investments and systems integration to deliver benefits to all consumers.

Electricity Generation (TWh)

- 23,816, 2014
- 48,491, Modern Jazz 2060
- 44,474, Unfinished Symphony 2060
- 44,914, Hard Rock 2060
3. **THE PHENOMENAL RISE OF SOLAR AND WIND ENERGY**

... will continue at an unprecedented rate and create both new opportunities and challenges for energy systems.

### Solar Electricity Generation

- **2014**: 0.2 TWh
- **Modern Jazz 2060**: 5.7 TWh
- **Unfinished Symphony 2060**: 7.9 TWh
- **Hard Rock 2060**: 3.3 TWh

### Wind Electricity Generation

- **2014**: 0.7 TWh
- **Modern Jazz 2060**: 8.8 TWh
- **Unfinished Symphony 2060**: 9.3 TWh
- **Hard Rock 2060**: 5.6 TWh
DEMAND PEAKS FOR COAL AND OIL

... have the potential to take the world from “Stranded Assets” to “Stranded Resources”.

![Graphs showing coal, oil, and natural gas demand trends from 2000 to 2060, with potential peaks near 2030 for coal and oil.]

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TRANSITIONING GLOBAL TRANSPORT...

... forms one of the hardest obstacles to overcome in an effort to decarbonise future energy systems.

Electric Vehicles of Light-duty Vehicle Fleets

- **Modern Jazz**
  - 2060
  - 26% of 3.0 billion

- **Unfinished Symphony**
  - 2060
  - 32% of 2.8 billion

- **Hard Rock**
  - 2060
  - 9% of 2.9 billion
LIMITING GLOBAL WARMING…

... to no more than a 2°C increase will require an exceptional and enduring effort, far beyond already pledged commitments and with very high carbon prices.
Wrap up

1. World’s Primary Energy Demand will slow down and per capita demand will peak before 2030

2. Demand for electricity will double until 2060

3. Phenomenal rise of Solar and Wind energy will continue

4. Demand peaks for coal and oil between 2030-2040

5. Transition of the global transport system is one of the biggest challenges

6. Limiting Global warming and tackle the climate challenge will require exceptional and unprecedented effort
Thank you

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