World Energy Scenarios

THE GRAND TRANSITION

BusinessNZ Energy Council – Exclusive member-only roundtable

Christoph Menzel I 10th July 2017 I Wellington – New Zealand

World Energy Scenarios

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Modern Jazz

Unfinished Symphony

Hard Rock

Pre-determined Elements of the Grand Transition

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	Factors shaped world energy 1970 - 2015	Pre-determined elements 2015 - 2060
Population / Workforce	▪ Global population grew 2x (1.7% p.a.)	▪ Global population will grow 1.4x (0.7% p.a.)
New Technologies	▪ ICT revolution ▪ Productivity growth rate of 1.7% p.a.	▪ Pervasive digitalisation; combinatorial impacts and productivity paradox
Planetary Boundaries	▪ 1,900+ Gt CO_2 consumed	▪ 1,000 Gt CO_2 consumed to 2100 for the 2°C target
Shifts in Power	▪ Rapid economic rise of developing nations ▪ Growing role for global institutions, e.g. UNFCCC, IMF, WTO, G20	▪ 2030: India is most populous country ▪ 2035-45: China is the world's largest economy

Critical Uncertainties of the Grand Transition

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	Modern Jazz	Unfinished Symphony	Hard Rock
Productivity / Economic Growth	▪ GDP 3.3% p.a. (2015–2060) ▪ Digital boost ▪ Tech innovation ▪ GDP per capita 2060 US$ 30,600	▪ GDP 2.9% p.a. (2015–2060) ▪ Sustainable growth ▪ Circular economies ▪ GDP per capita 2060 US$ 25,200	▪ GDP 1.7% p.a. (2015–2060) ▪ Fragmented markets ▪ Local content ▪ GDP per capita 2060 US$ 14,700
Climate Challenge	▪ Cumulative carbon emission 2015-60 1,491 Gt CO2	▪ Cumulative carbon emission 2015-60 1,165 Gt CO2	▪ Cumulative carbon emission 2015-60 1,642 Gt CO2
International Governance	▪ Economics focused international governance	▪ Broad-based international governance	▪ Fractured and weak international system
Tools for Action	▪ Markets	▪ States	▪ Patchwork of states and markets

Three Scenarios

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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

1 THE WORLD'S PRIMARY ENERGY DEMAND GROWTH

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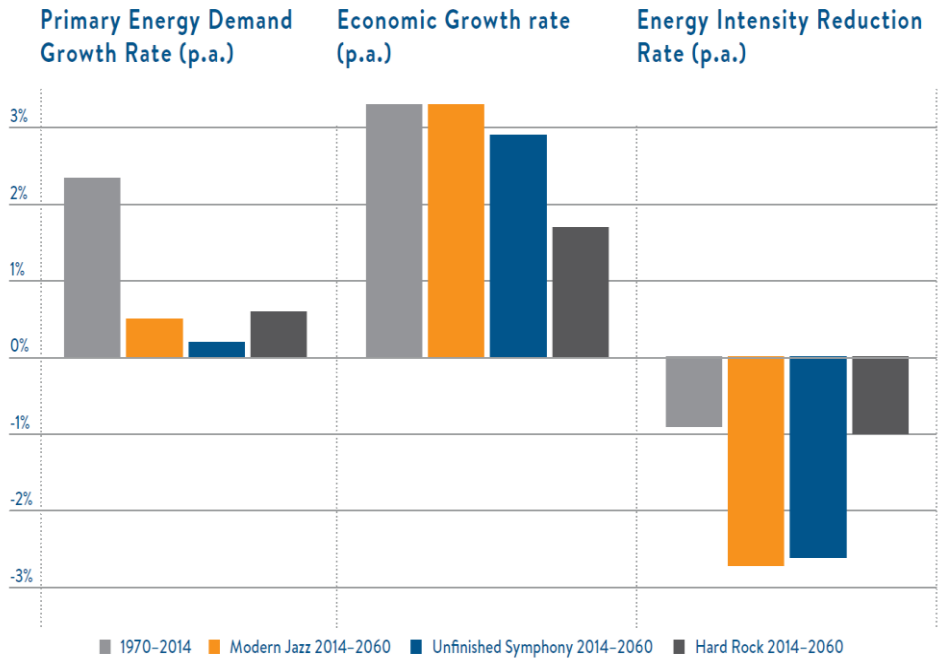
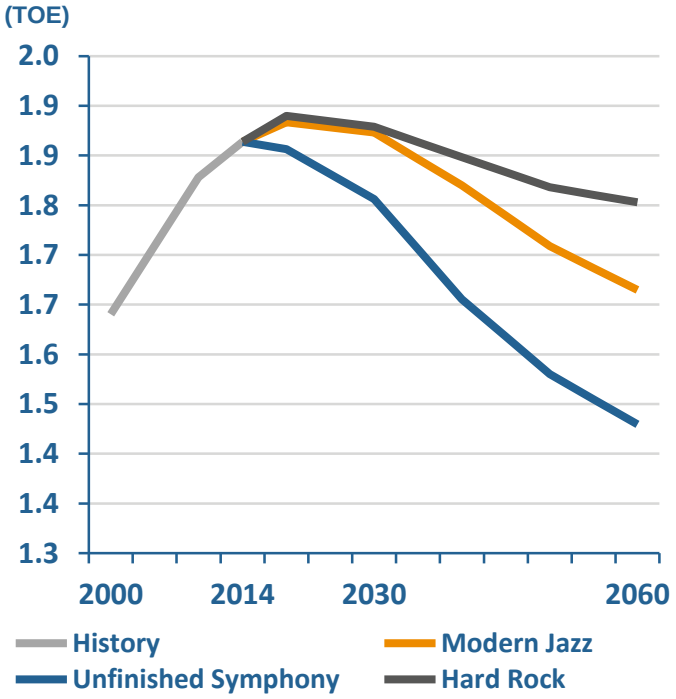
… will slow and per capita energy demand will peak before 2030 due to unprecedented efficiencies created by new technologies and more stringent energy policies.

Slower Primary Energy Demand Growth



Per Capita Primary Energy Demand



2 DEMAND FOR ELECTRICITY

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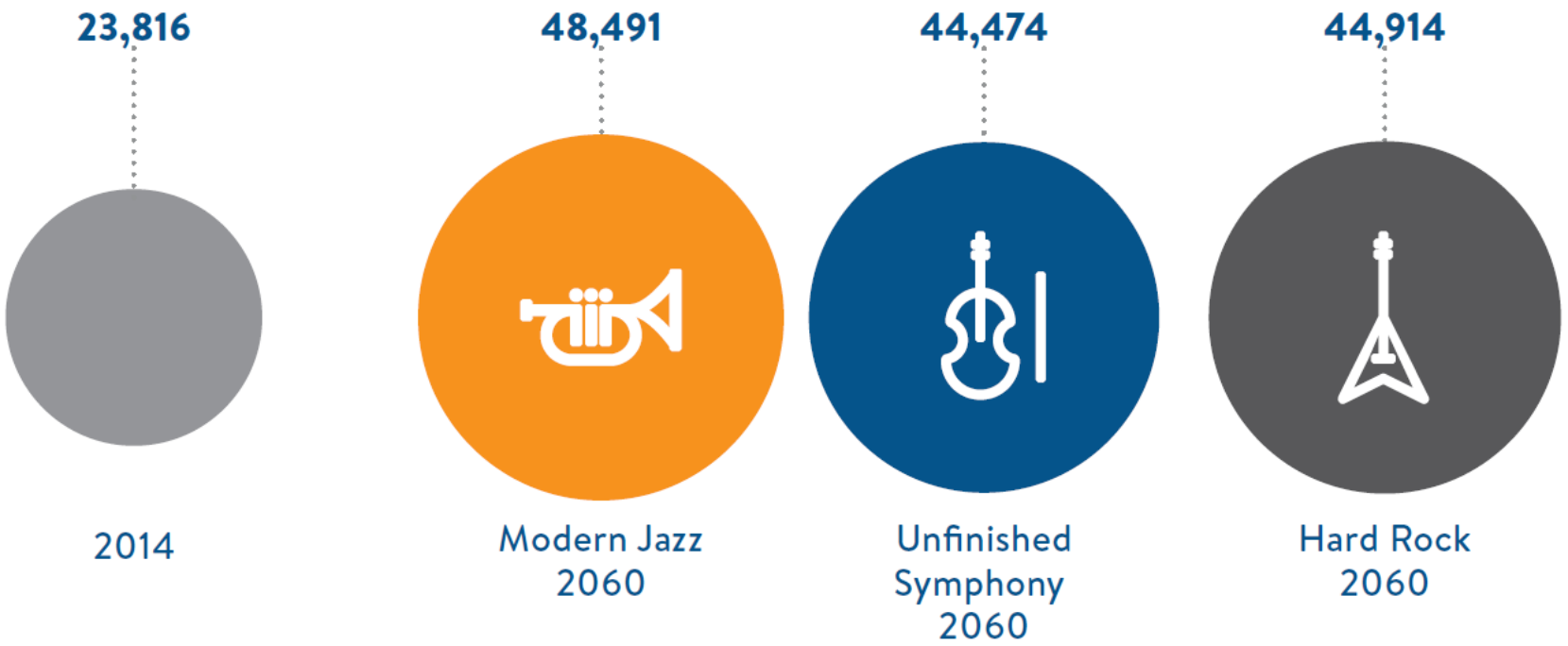
… will double to 2060. Meeting this demand with cleaner energy sources will require substantial infrastructure investments and systems integration to deliver benefits to all consumers.

Electricity Generation
(TWh)



3 THE PHENOMENAL RISE OF SOLAR AND WIND ENERGY

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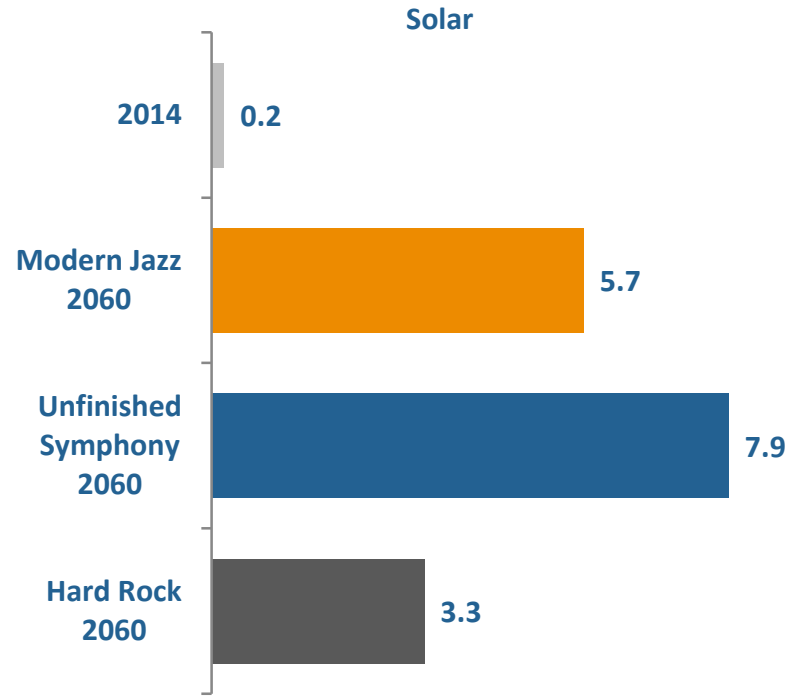
… will continue at an unprecedented rate and create both new opportunities and challenges for energy systems.

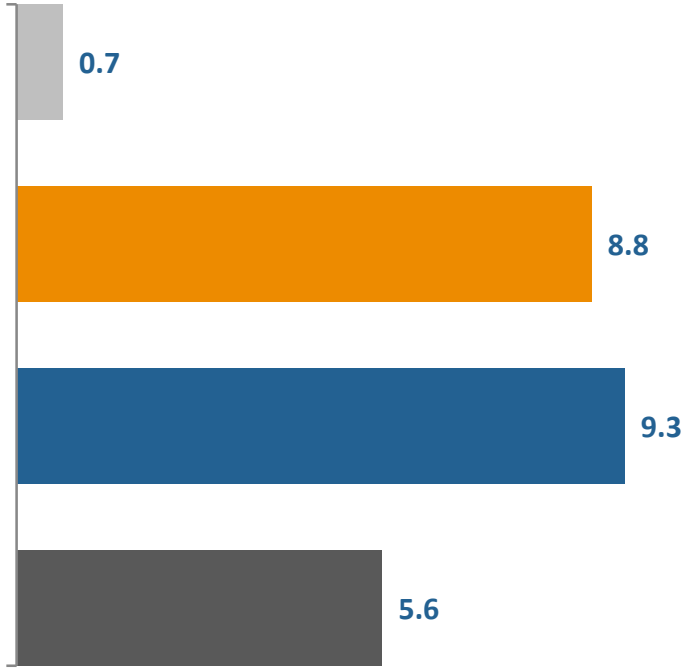
Solar Electricity Generation

('000 TWh)



Wind Electricity Generation

('000 TWh)



4 DEMAND PEAKS FOR COAL AND OIL

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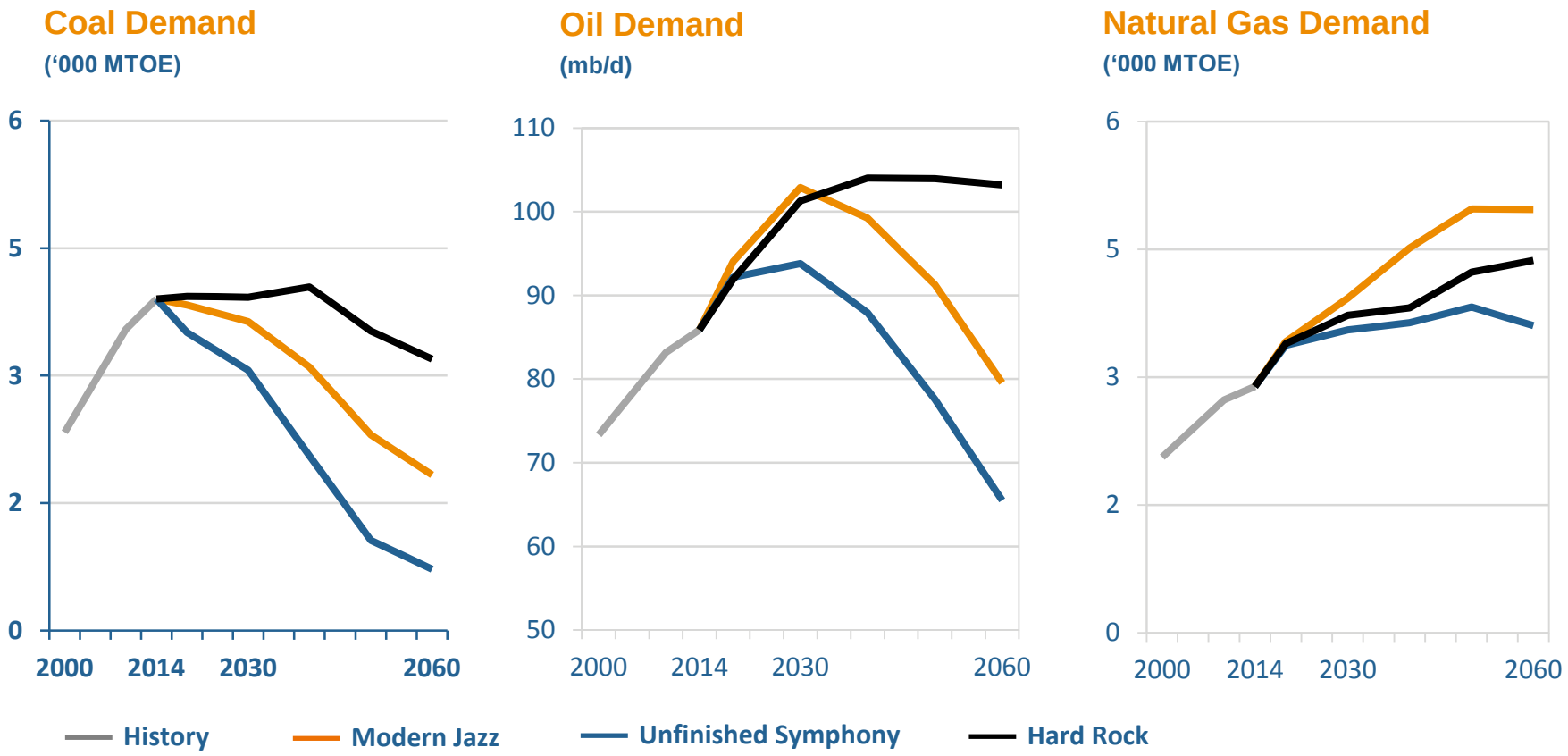
… have the potential to take the world from “Stranded Assets” to “Stranded Resources”.



5 TRANSITIONING GLOBAL TRANSPORT…

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… 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

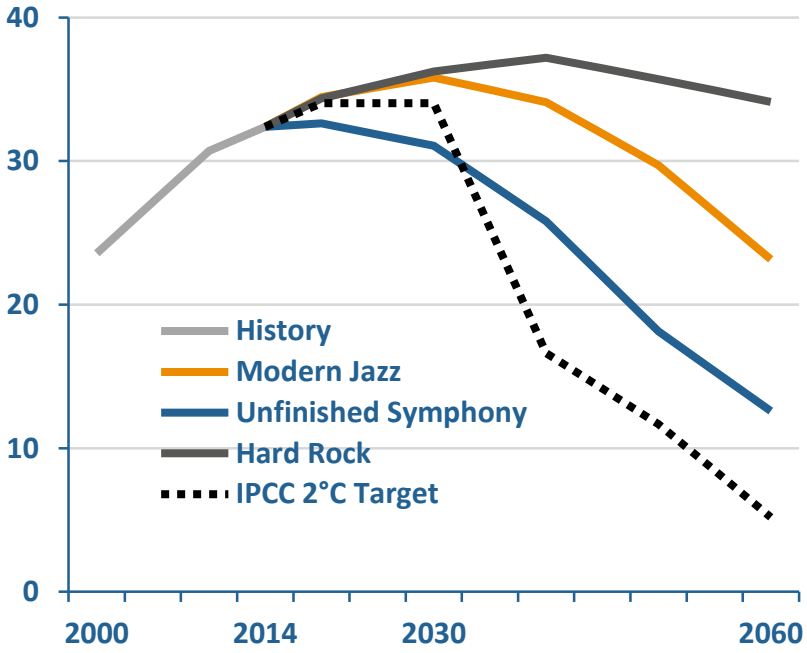
9% of 2.9 billion

6 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.

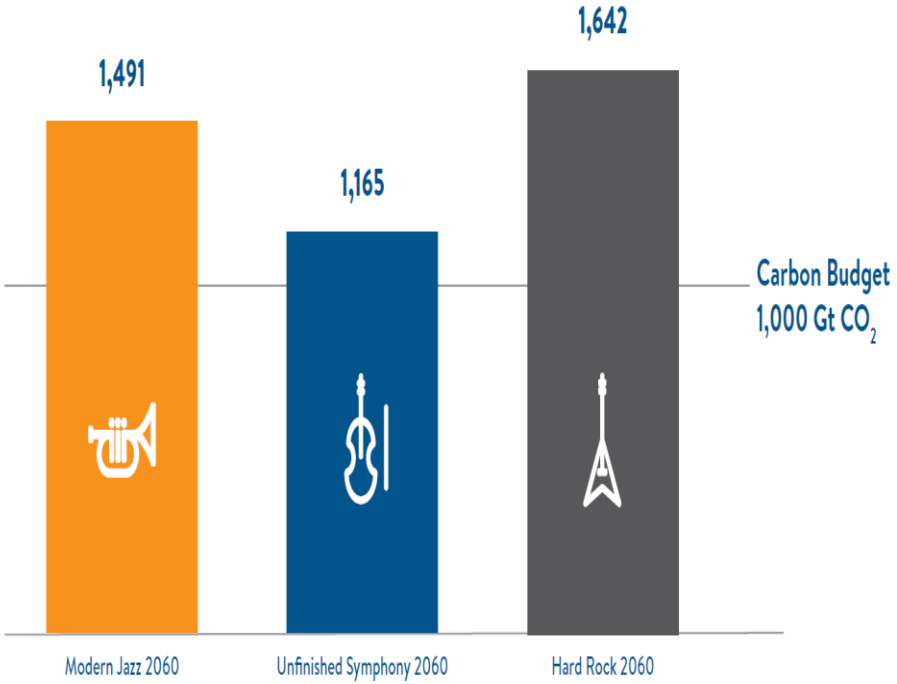
Annual Carbon Emissions

(Gt CO_2)



Cumulative Carbon Emissions 2015-2060

(Gt CO_2)



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

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Thank you

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Please see the full report for further details.