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Best Global Energy Mix for 2030
WEC Energy Scenarios Asia

IEEJ 50th / APERC 20th Anniversary Joint Symposium 2016

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Global total primary energy supply

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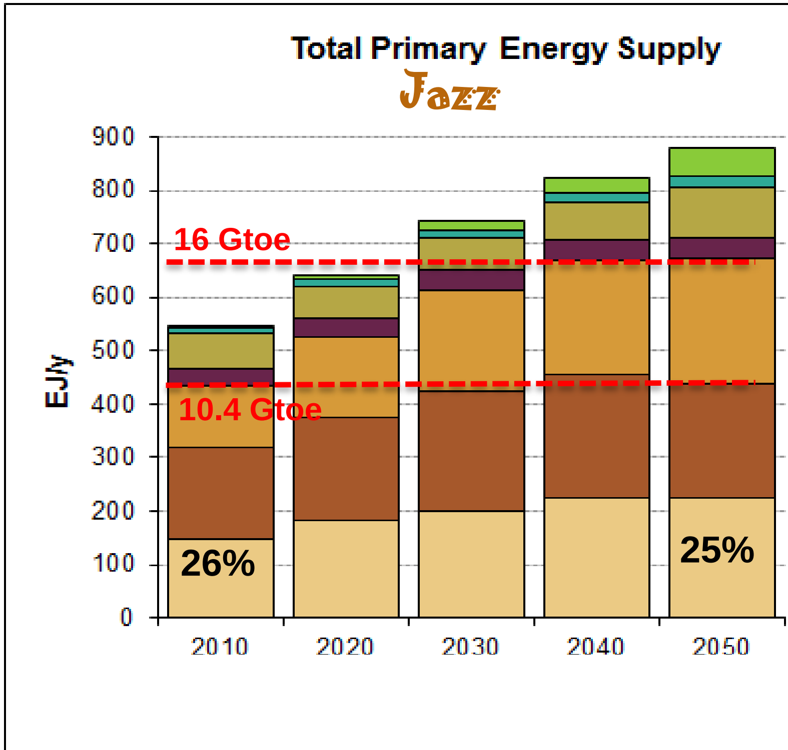
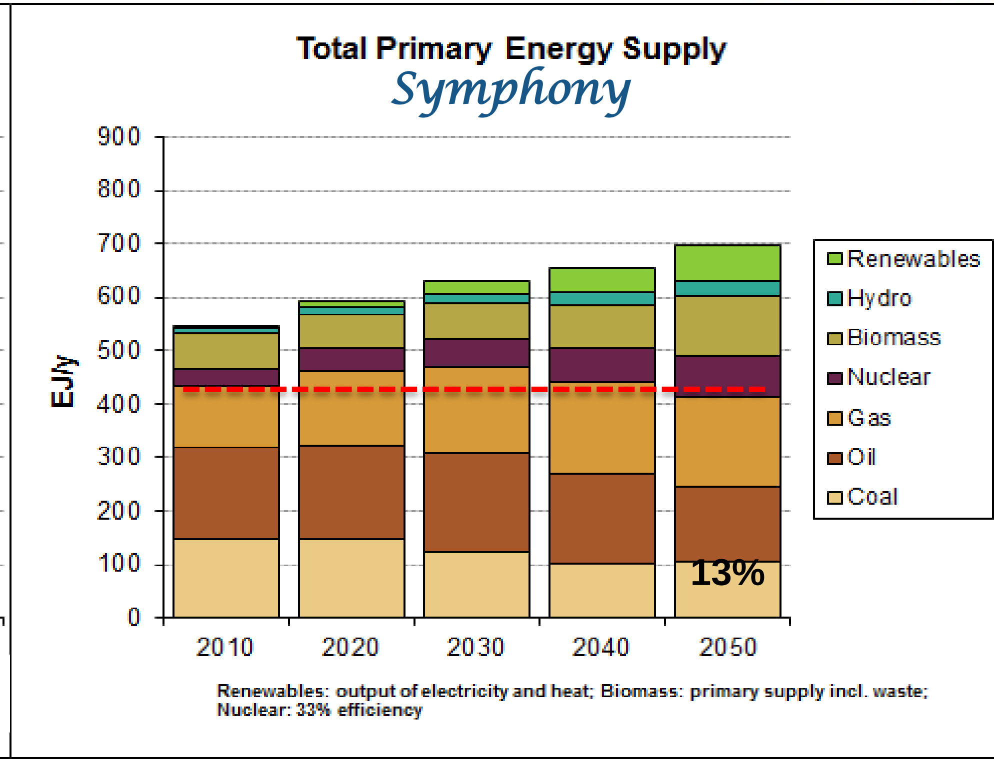


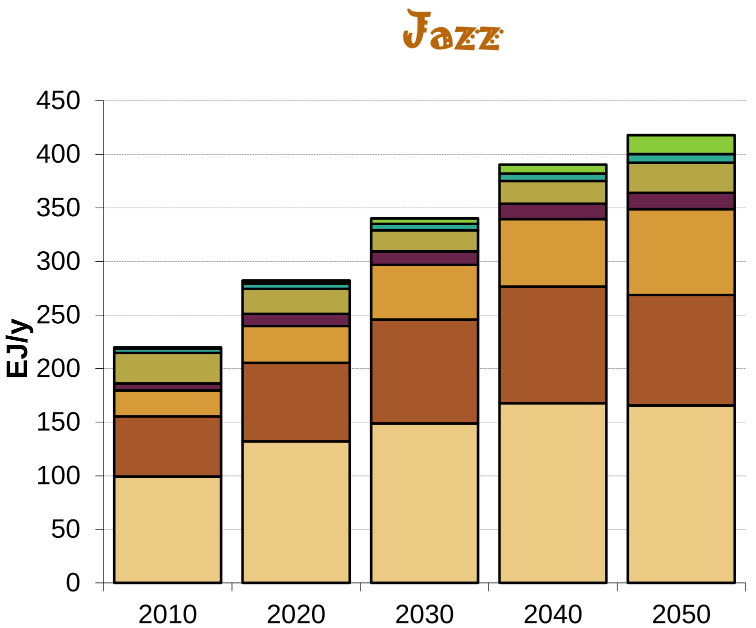


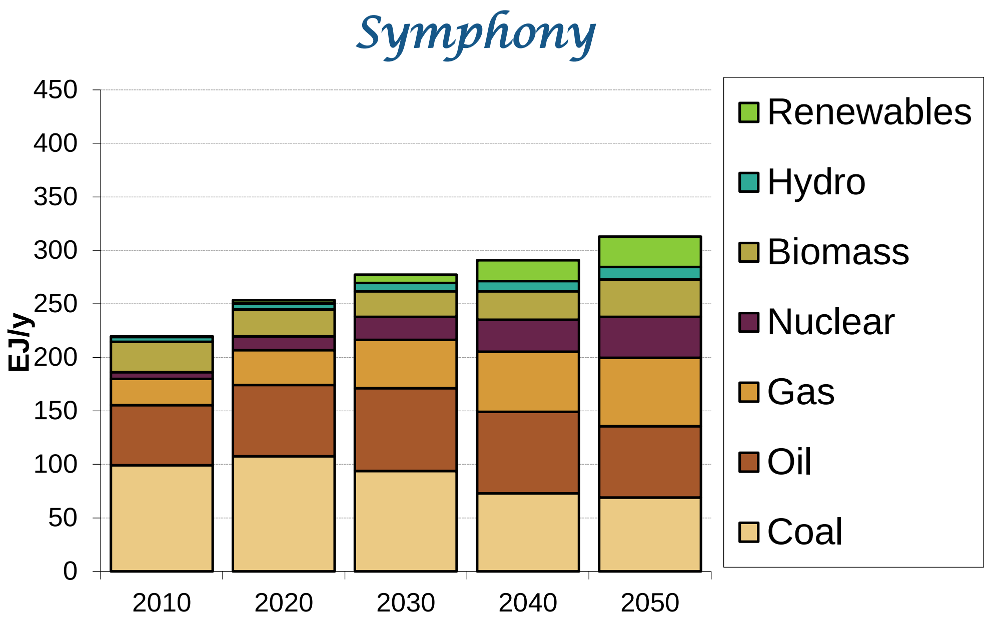
Jazz +61% | **+ 27% Symphony**

Upstream liberalized;
Technology development,
Supply surge/more producers
Coal remains dominant in some regions

Tighter supply (lower E&P)
Higher infrastructure costs
Energy security drives reduced fossil use

Asia total primary energy supply





Renewables: output of electricity and heat; Biomass: primary supply incl. waste; Nuclear: 33% efficiency

Jazz	+90%	+42%	Symphony

Coal and oil remain dominant peaking in 2040
Gas continues to increase
Modest increases in renewables

Coal peaks by 2030, oil by 2040
Gas renewables and nuclear all increase

Global Electricity Production and Capacity

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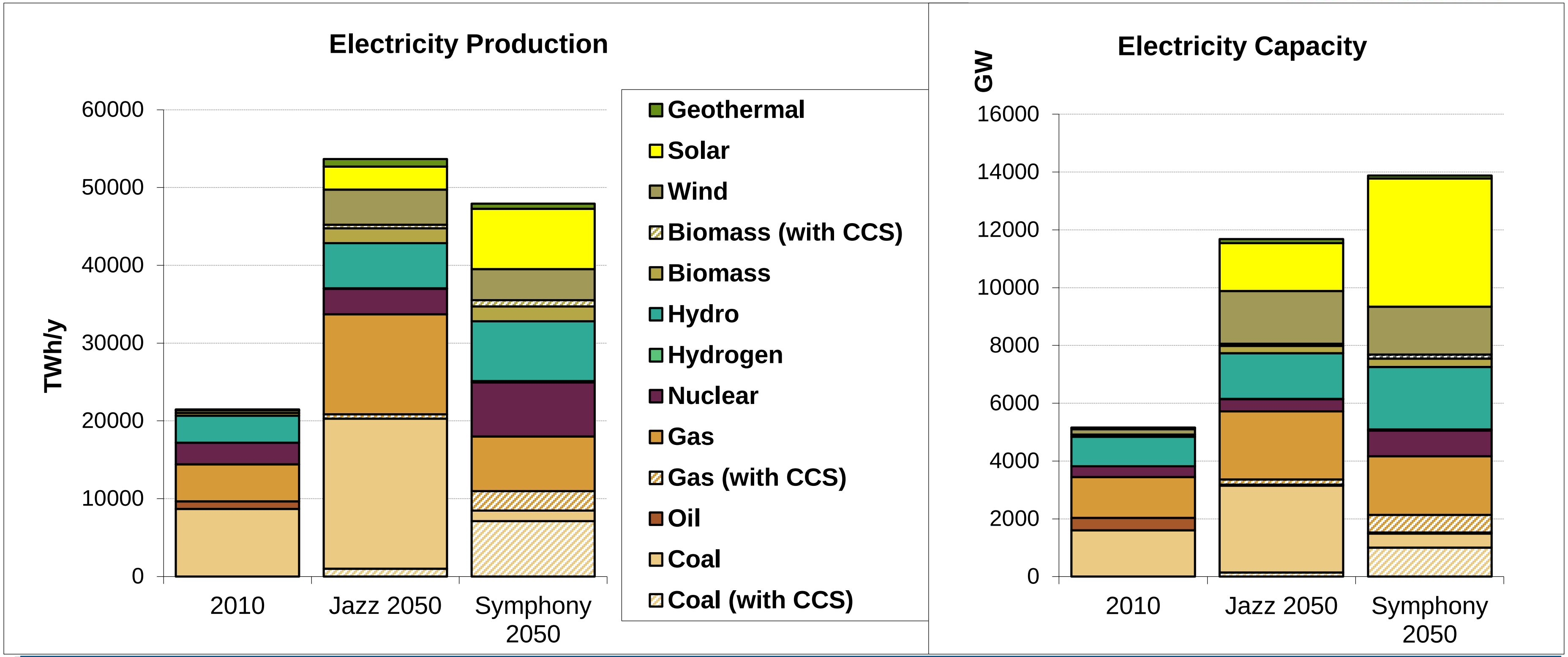

Jazz	Symphony
Coal: remains dominant Gas: share increases (esp. N. America), Nuclear: mainly non-OECD	Coal: share drops, CCS increasingly required Nuclear: increasing; led by governments More stable & quicker transition to renewables

Electricity production in Asia by primary energy

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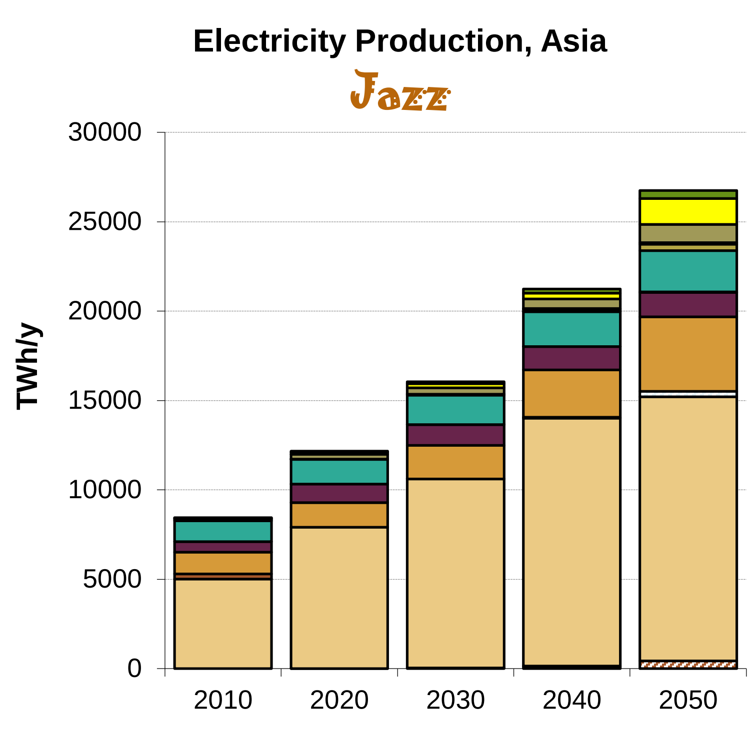

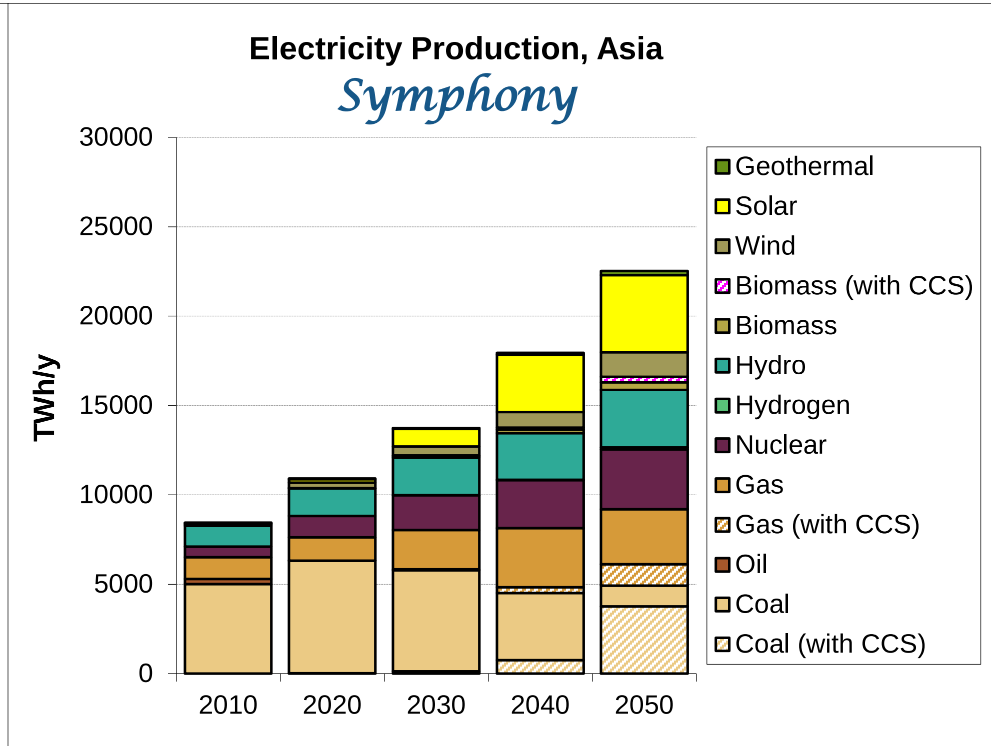

Jazz **+217%** **+167%** **Symphony**

Demand more than triples
Big increases in coal and gas with little CCS
Renewables and Nuclear double

Demand almost triples
Coal flattens mostly with CCS
Renewables especially solar take off
Nuclear is critical part of the mix

Electricity Cumulative Capital Investment in Asia

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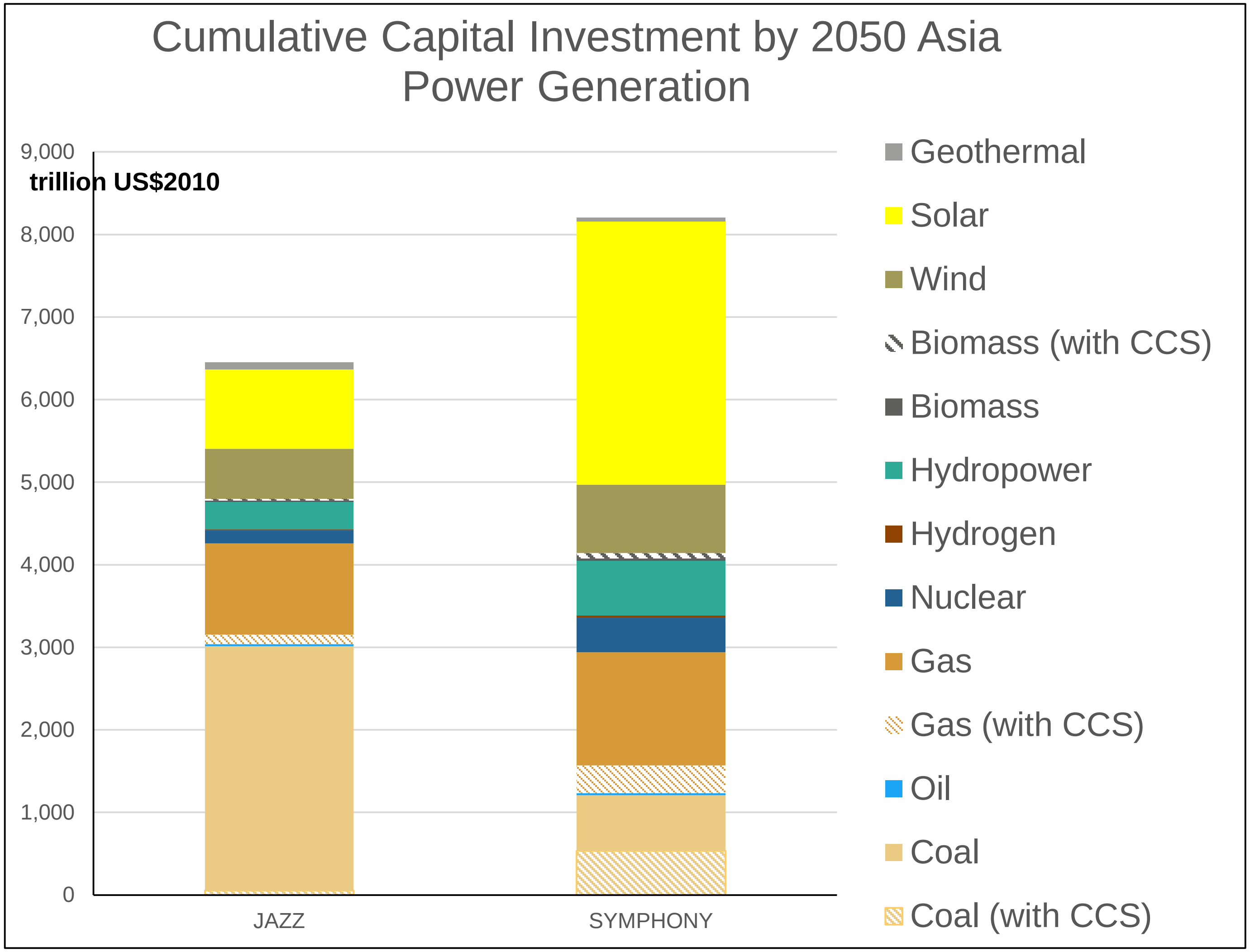
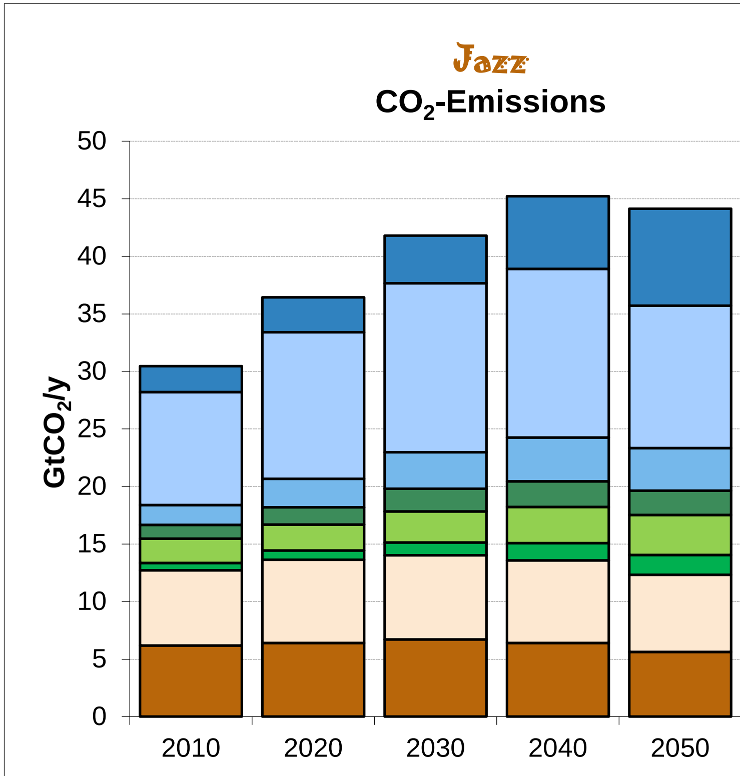
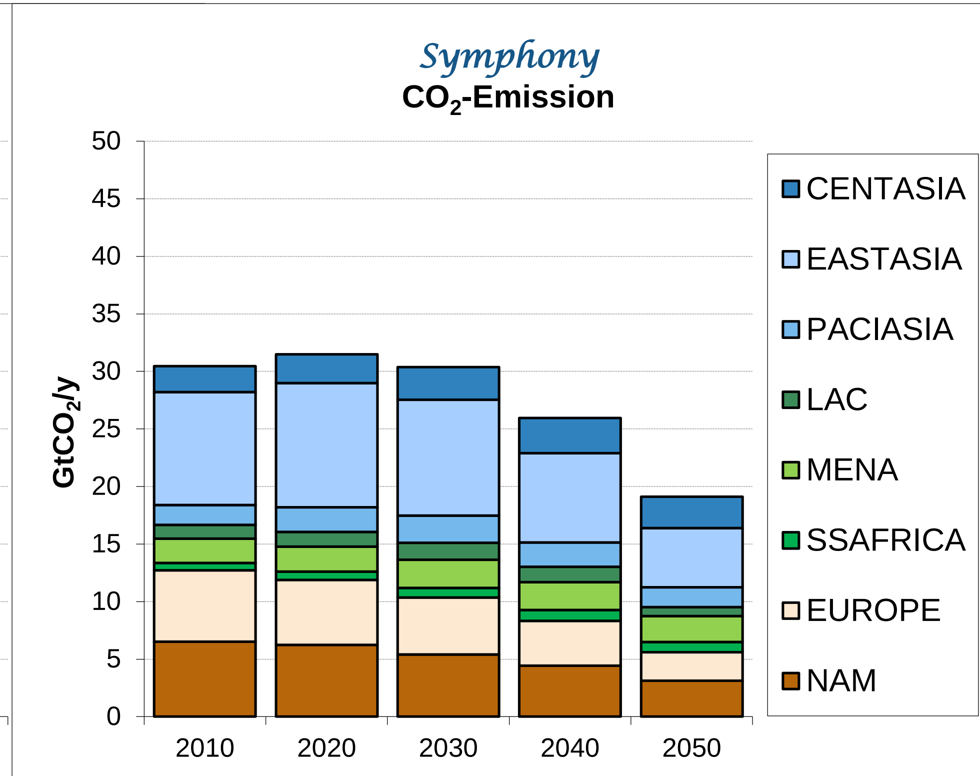


CO_2 emissions by region





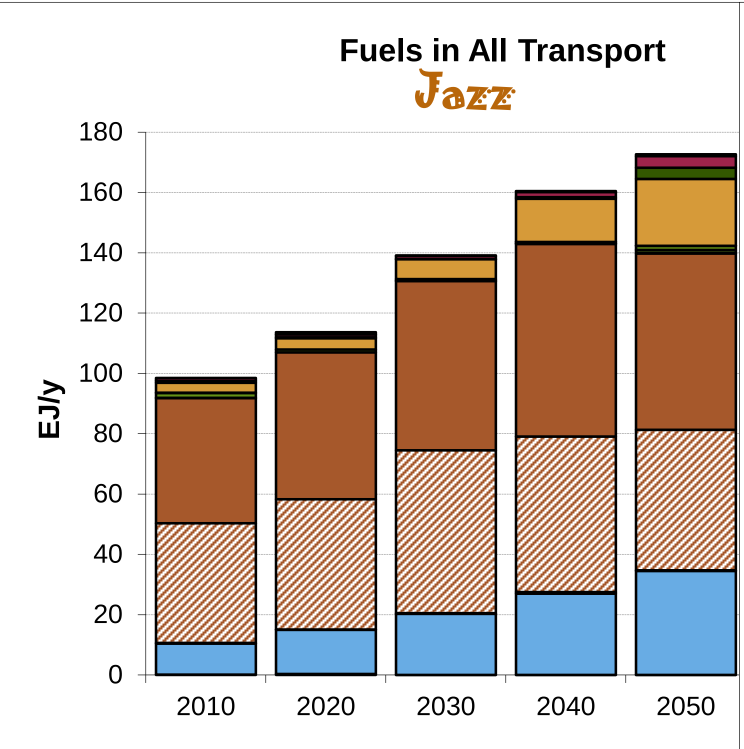
Jazz +45% (+78%) -37% (-30%) Symphony

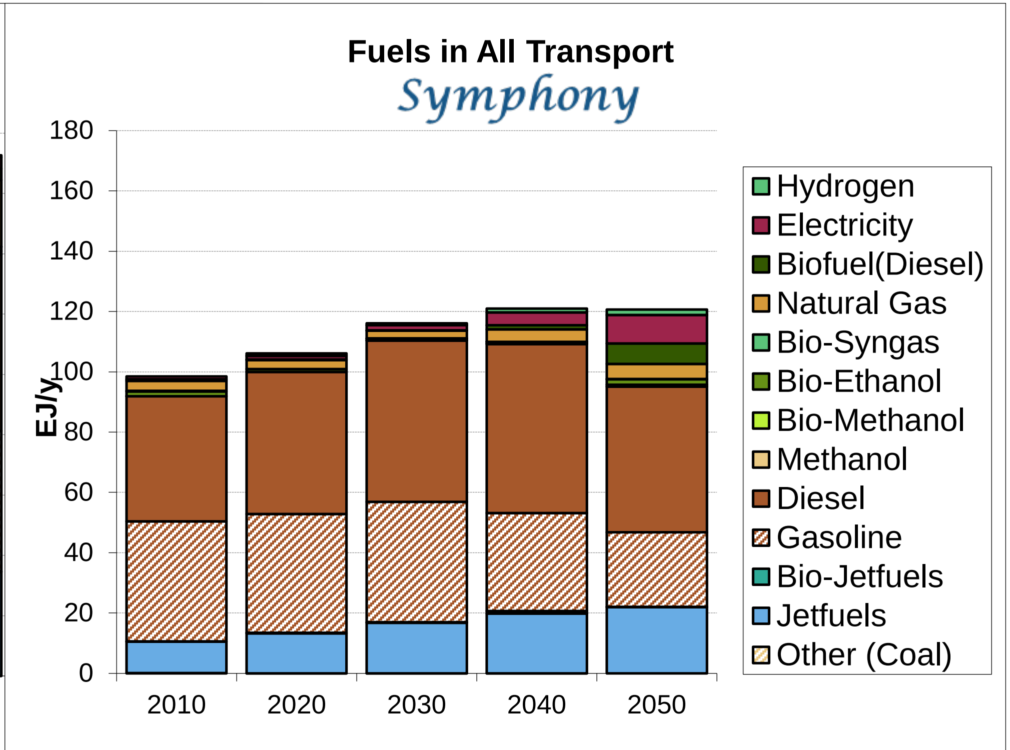
Emissions rise and don't peak until after 2040.

Emissions peak before 2030 and drop by over a third

Still above 2°C target

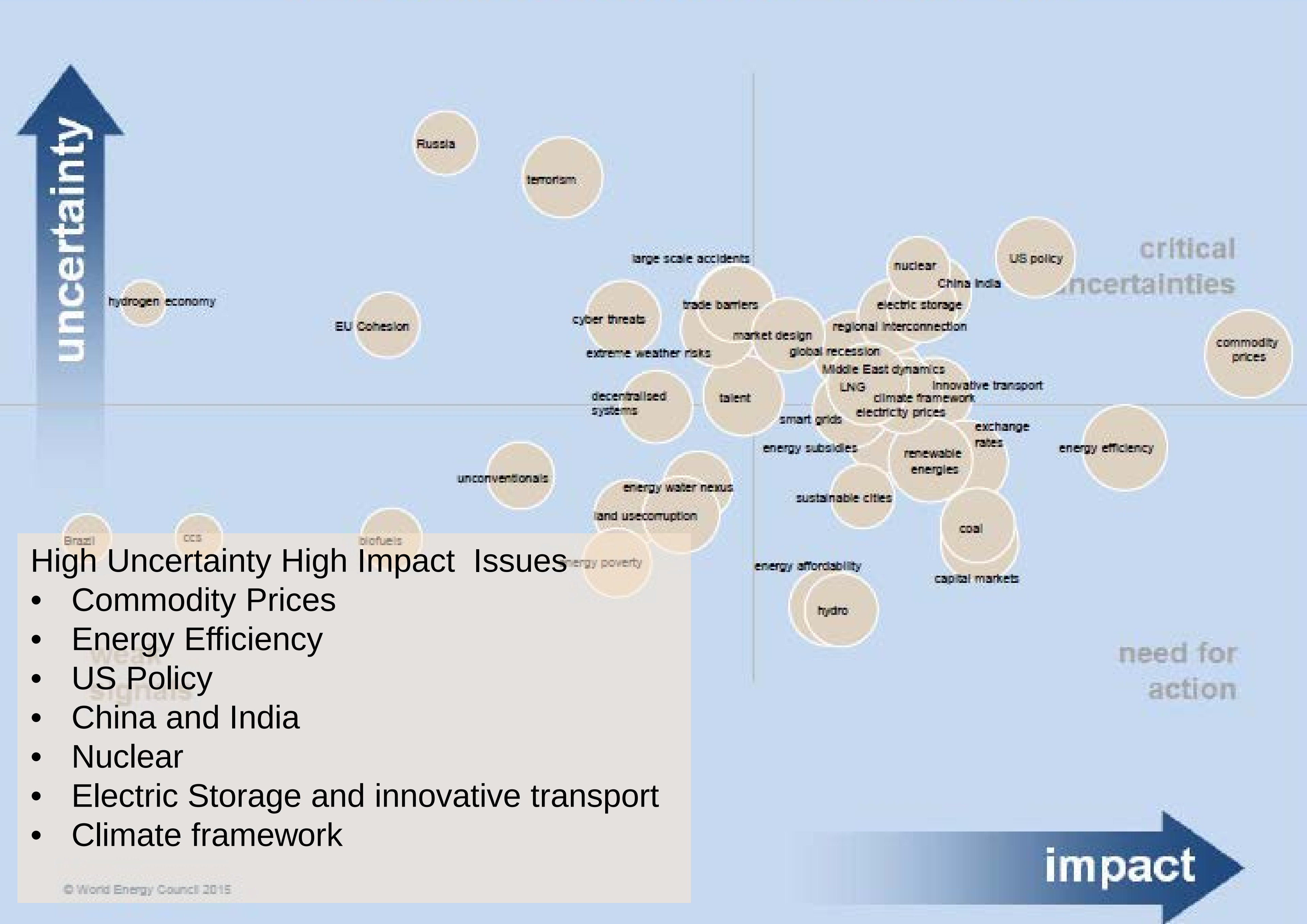
Fuels in All Transport





Jazz +75%	+22% Symphony
Growth leads to higher consumption	Lower consumption, high impact of energy saving and lower growth
Improved access to energy.	Demand increases by 22%
Demand increases by 75%	Switch away from fossil fuels which peak in 2030
Switch to natural gas	

Results for the 2016 World Energy Issues Monitor - Asia



High Uncertainty High Impact Issues

- Commodity Prices
- Energy Efficiency
- US Policy
- China and India
- Nuclear
- Electric Storage and innovative transport
- Climate framework

Energy mix in 2050

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- **Energy efficiency** is absolutely crucial in dealing with demand outstripping supply in both Scenarios
- **Coal** remains a dominant fuel in Jazz (especially in China and India), CCS is critical to coal in Symphony.
- **Natural gas** will gain more importance in the energy share especially in Jazz
- **Oil** will continue to be the dominant fuel in transport with growth in natural gas in Jazz and Biofuels and electricity in Symphony
- **Nuclear** is not a game changer but is important in Symphony
- **Hydro**: great economic potential of hydro electricity generation especially in SSA and LAC
- Share of **renewables** increases in Symphony. Solar takes off.