Energie Szenarien 2050

Die Bedeutung von Öl und Gas für den Energiemix der Zukunft

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Wir leben in einem Umfeld der starken Veränderungen und Herausforderungen…

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Unsicherheiten der strategischen Planung

…wenn das Ziel nicht klar ersichtlich ist.....

Kritische Faktoren die den Energiemix der Zukunft bestimmen

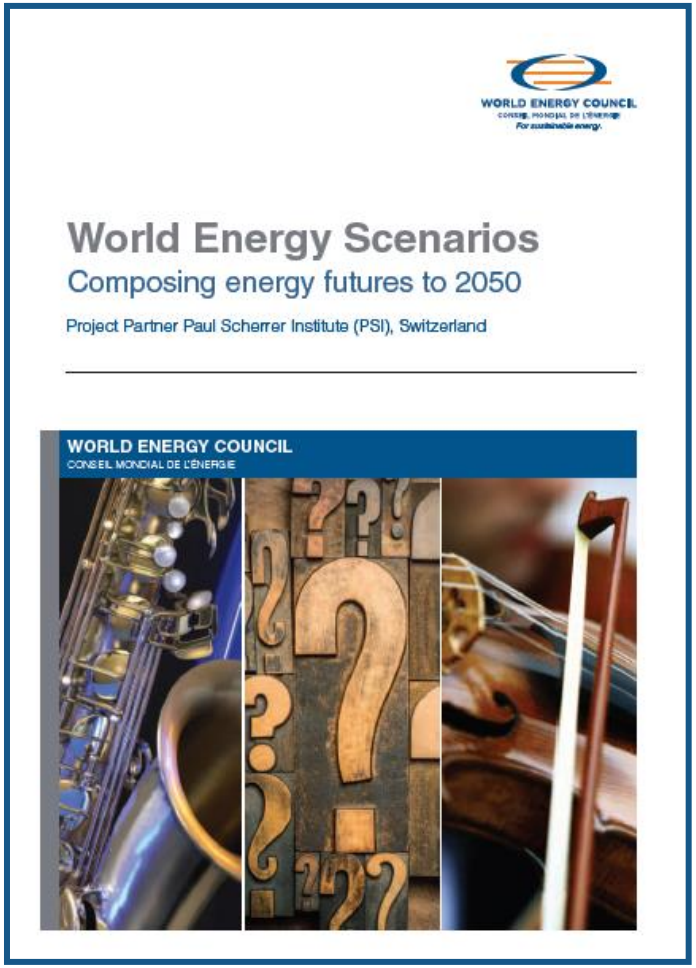
- Energiemärkte stehen vor beispiellosen Unsicherheiten
  - Weitere wirtschaftliche Entwicklung
  - Einfluß von Unkonventionellem Öl und Gas
  - Investitionen in Energieinfrastruktur
  - Wechselnde gesellschaftliche/politische Prioritäten
- Evolution des Energiesystems in China
- Regulierung und politische Rahmenbedingungen
- Starke regionale Unterschiede und Prioritäten

Die Weltenergieszenarien 2050

Comprises of two scenarios

The scenarios are designed to help a range of stakeholders to address the “energy trilemma” – of achieving environmental sustainability, energy security and energy equity.

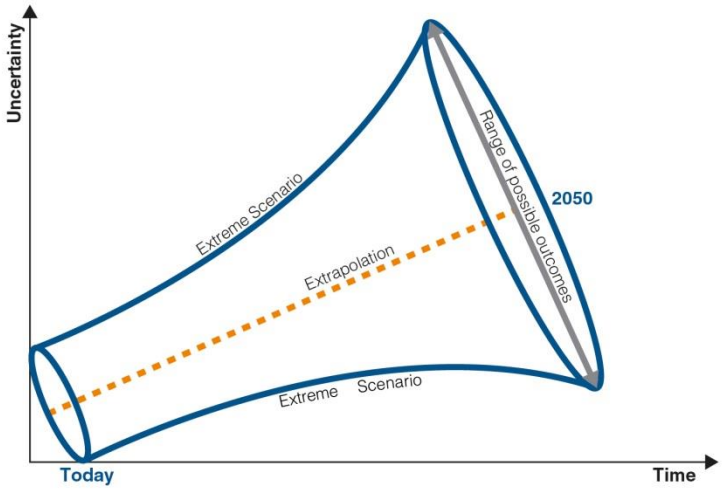
Stories quantified by Paul Scherrer Institute (project partner) based on a global and regional MARKAL GMM model



Was sind Szenarien?

Plausible, pertinent, alternative stories of the future which:

- portray a range of conceivable outcomes and aid the understanding of how differer factors can interact and shape the future.
- identify robust trends; ‘what-if’ assumptions about future. Scenarios are not forecast.
- inform debate regarding the future energy landscape; foundation for company investment decisions & government policies



The uncertainty funnel:
WEC Scenarios are explorative, rather than normative

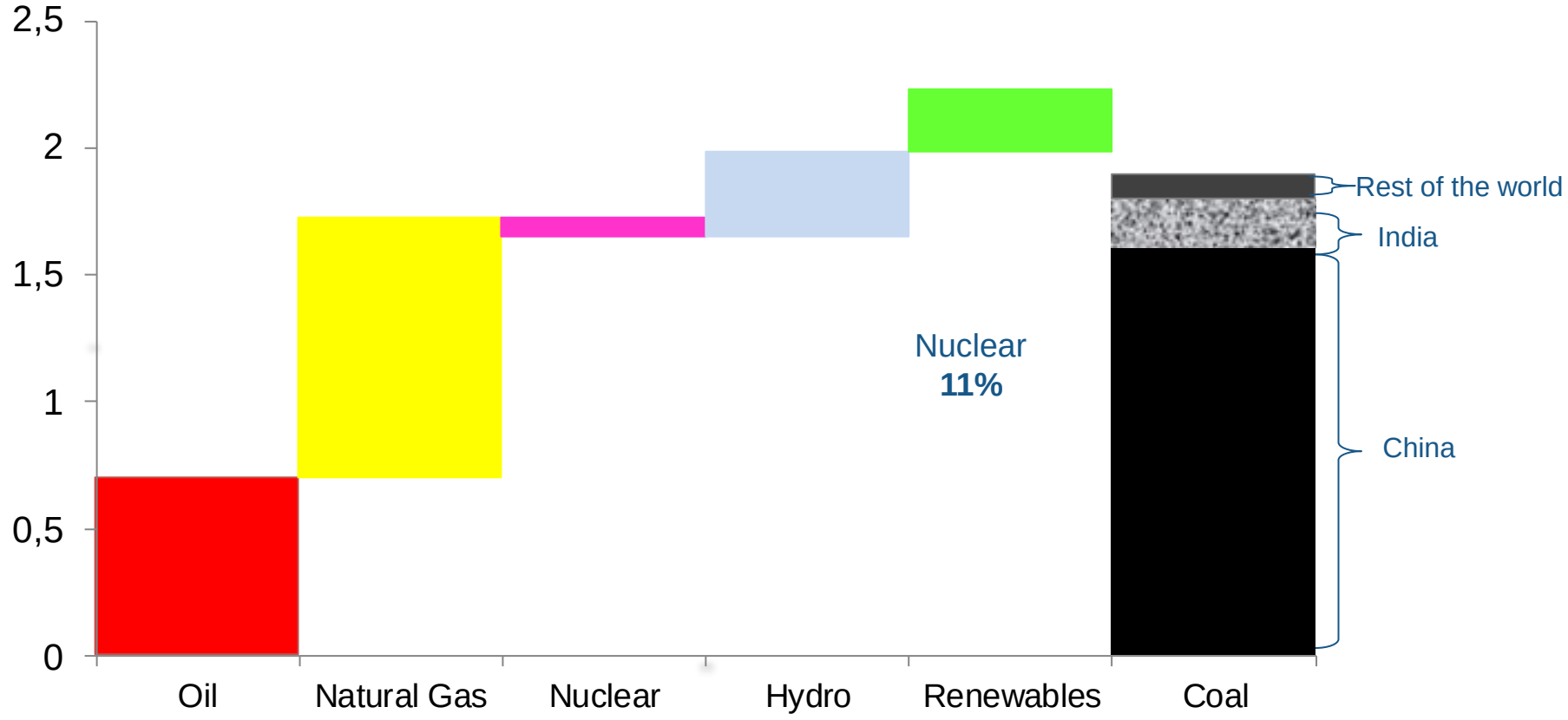
Kurzbeschreibung der Szenarien

Jazz	Symphony
World where there is a consumer focus on achieving energy access, affordability, and individual energy security with the use of best available energy sources.	World where there is a voter consensus on driving environmental sustainability and national energy security through corresponding practices and policies. There is International Climate Change agreement by 2015
Main players are multi-national companies, banks, venture capitalists, and price- conscious consumers	Main players are governments, international agencies ,local public-sector and private companies, NGOs and environmentally-minded voters
Technologies are chosen in competitive markets	Governments pick technology winners
Energy sources compete on basis of price & availability	Select energy sources are subsidised and incentivized by governments
Higher GDP growth due to optimised (efficient) market practices.	Lower GDP due to non-optimal economic policies
Free-trade strategies lead to increased exports	Nationalistic strategies result in reduced exports/imports
Renewable and low carbon energy grows in line with market selection	Certain types of renewable and low carbon energy actively promoted by governments
In the absence of international agreed commitments Carbon market grows more slowly from bottom up based on regional, national and local initiatives.	Carbon market is top down based on an international agreement, with commitments and allocations.

Der Blick zurück:
Global primary energy demand: 2002-2012

billion t coal equivalent

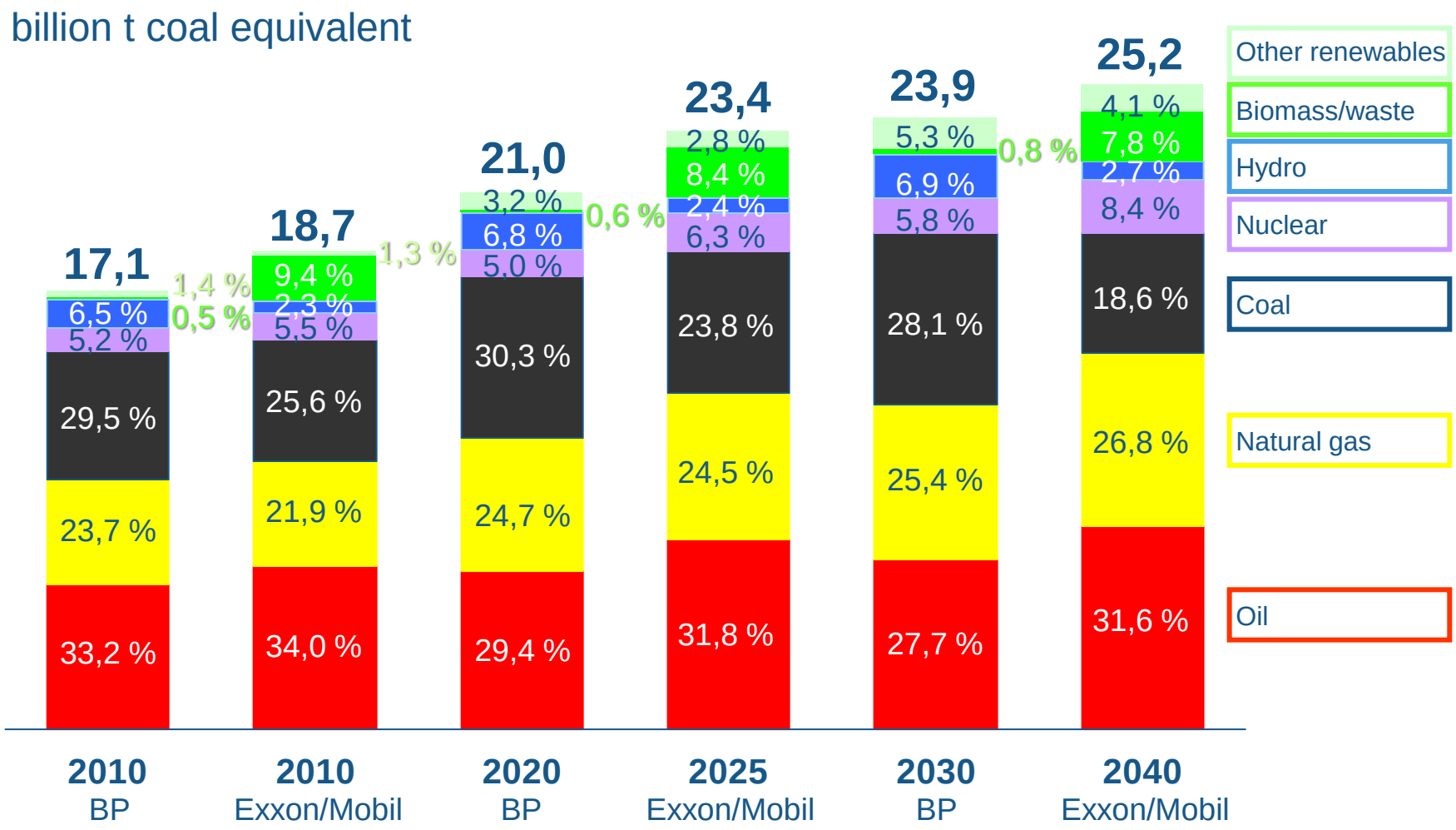
4,1 Billion t coal equivalent increase –
46 % of which are coal



Source: BP Statistical Review of World Energy June 2013

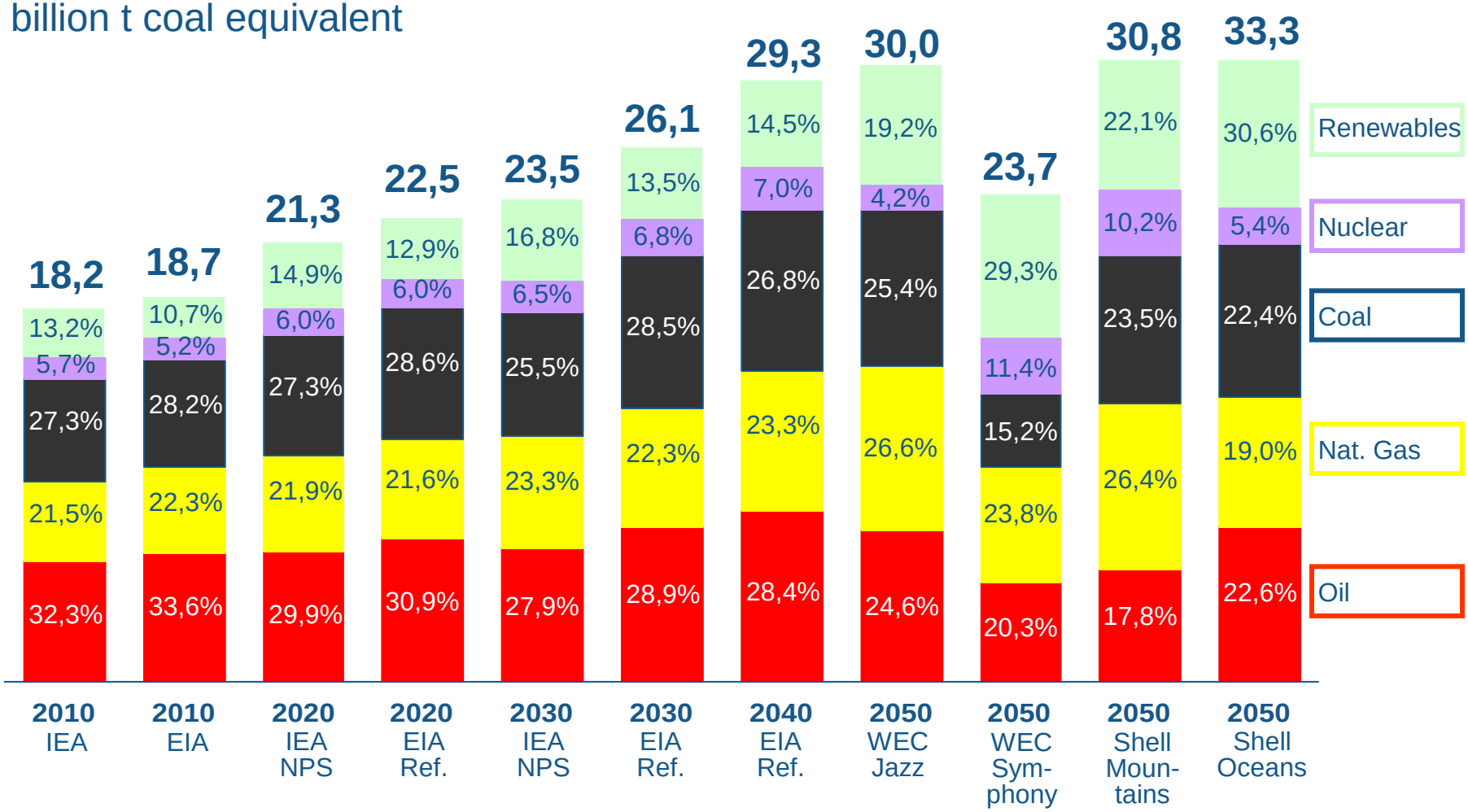
Billion: 10^9

Der Blick nach vorne: Primary energy demand by energy type

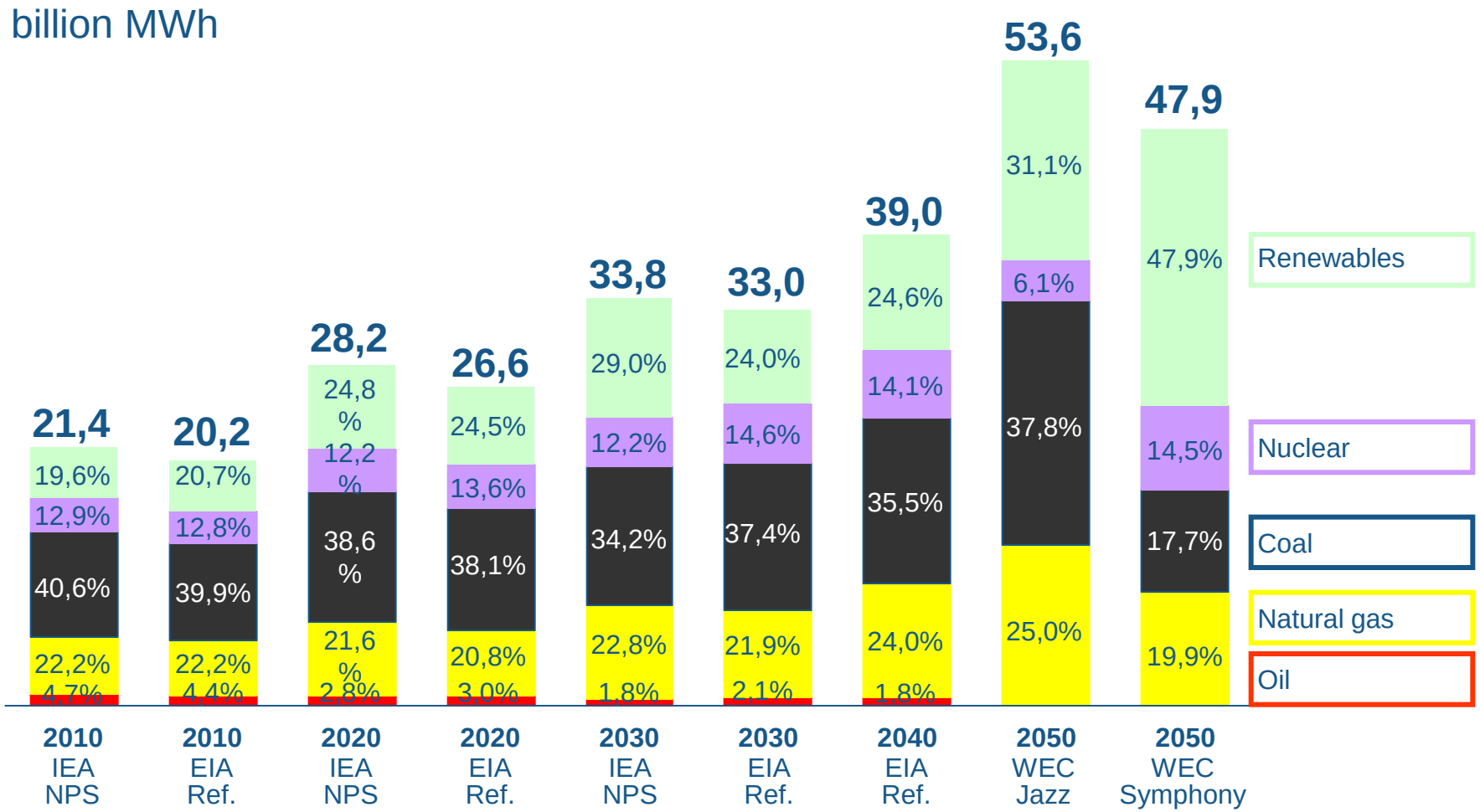


WEC Szenarien:
Primary energy supply by energy type

billion t coal equivalent

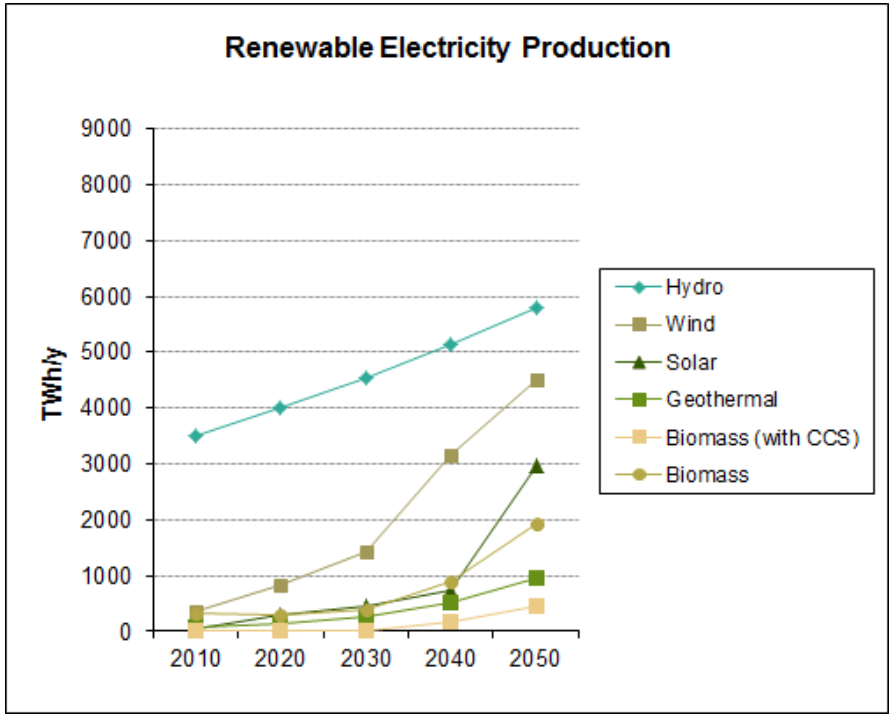


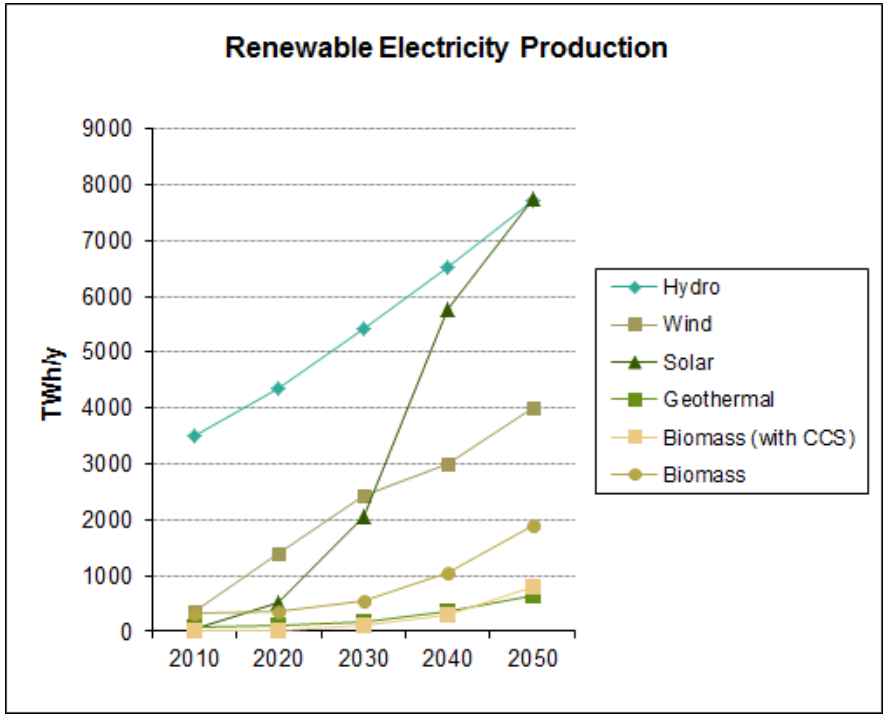
WEC Szenarien:
Global electricity generation by fuel type



Note: IEA and WEC incl. own consumption; EIA excl. own consumption

Stromerzeugung durch Erneuerbare Energien





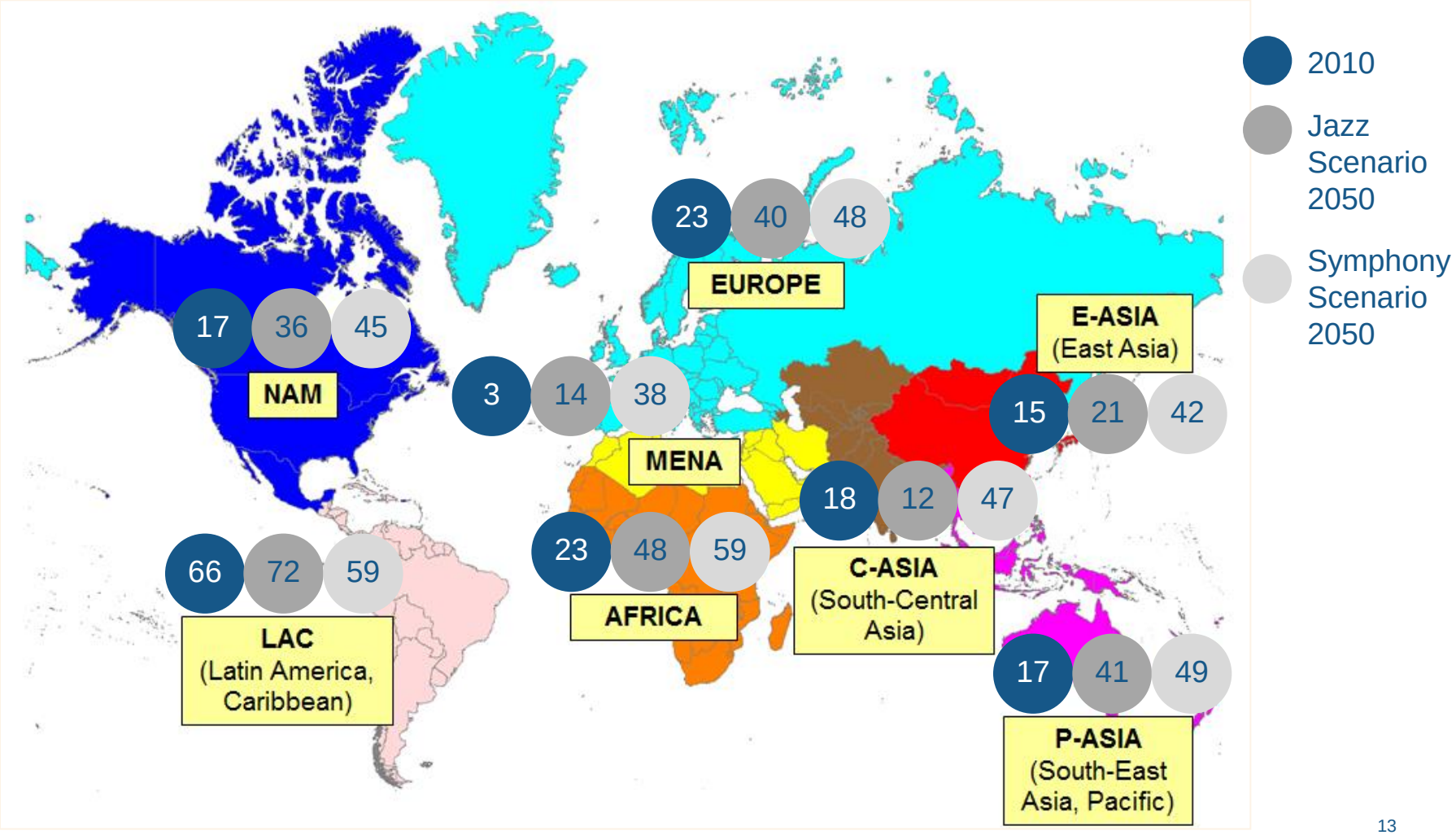
Jazz

Hydro and wind electricity are competitive. Renewables account for roughly 30% of total electricity generation by 2050.

Symphony

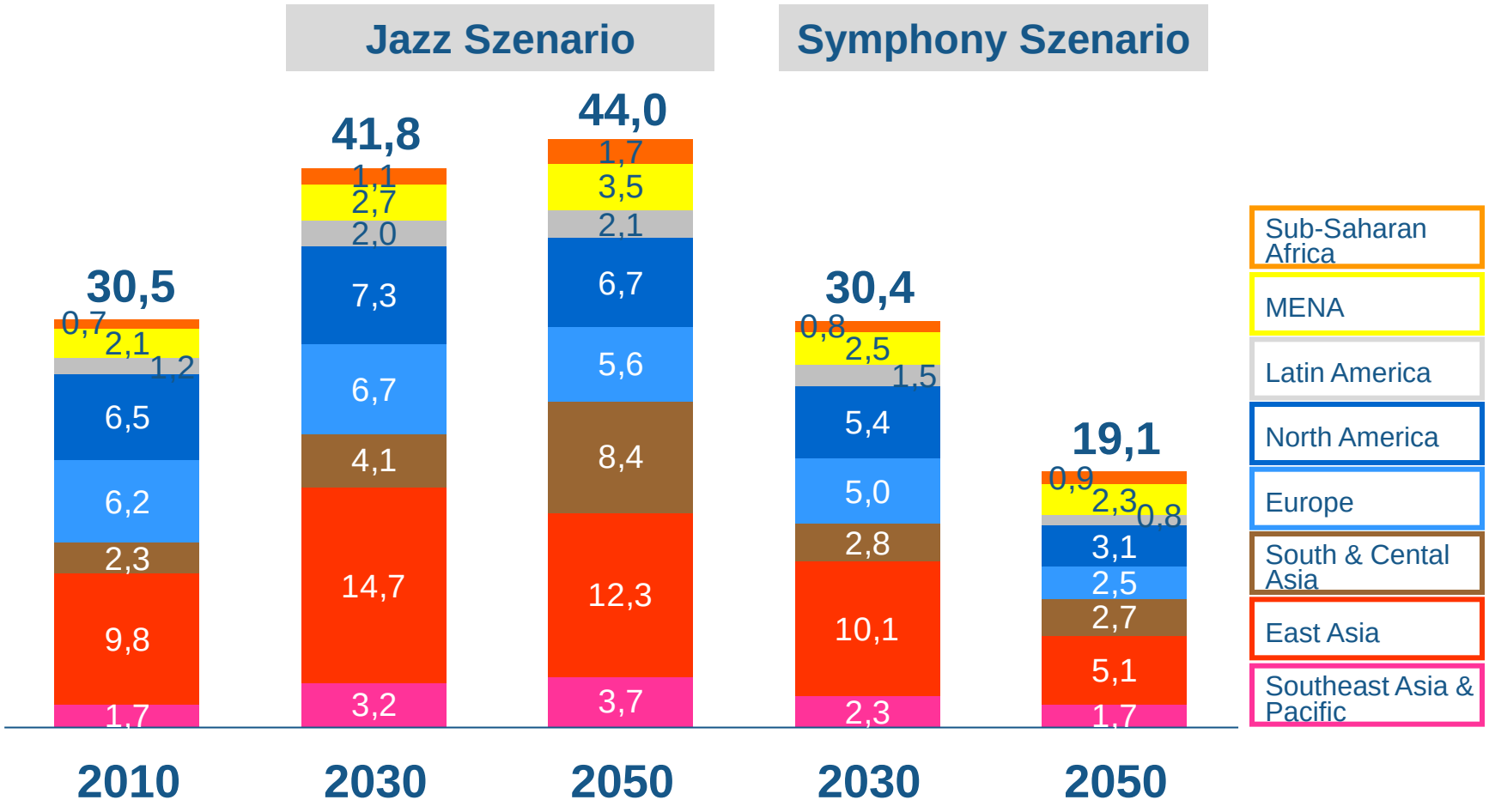
Renewables undergo rapid development, accounting for almost 50% of total electricity generation in 2050 (cf. 20% in 2010)

Anteil der Erneuerbaren an der Stromerzeugung pro Region



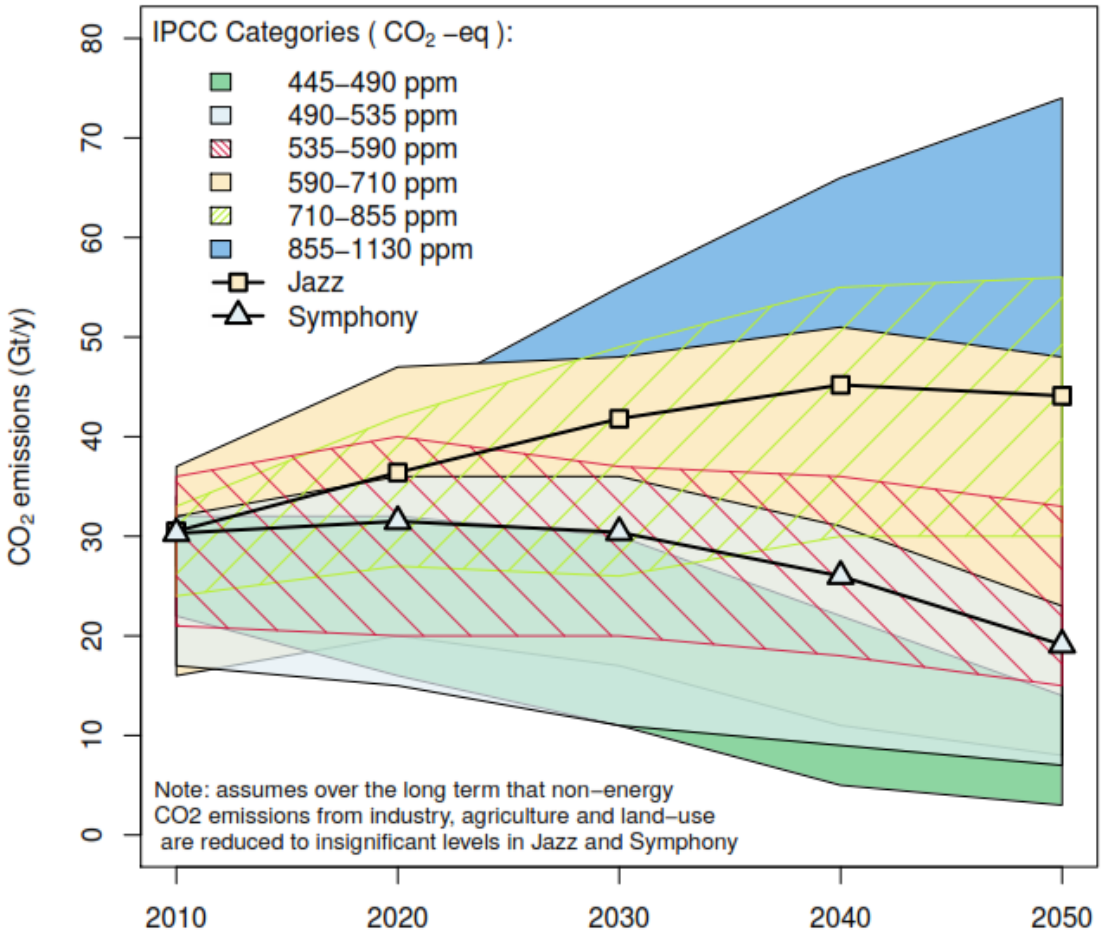
CO_2 Emissionen pro Region

in billion t



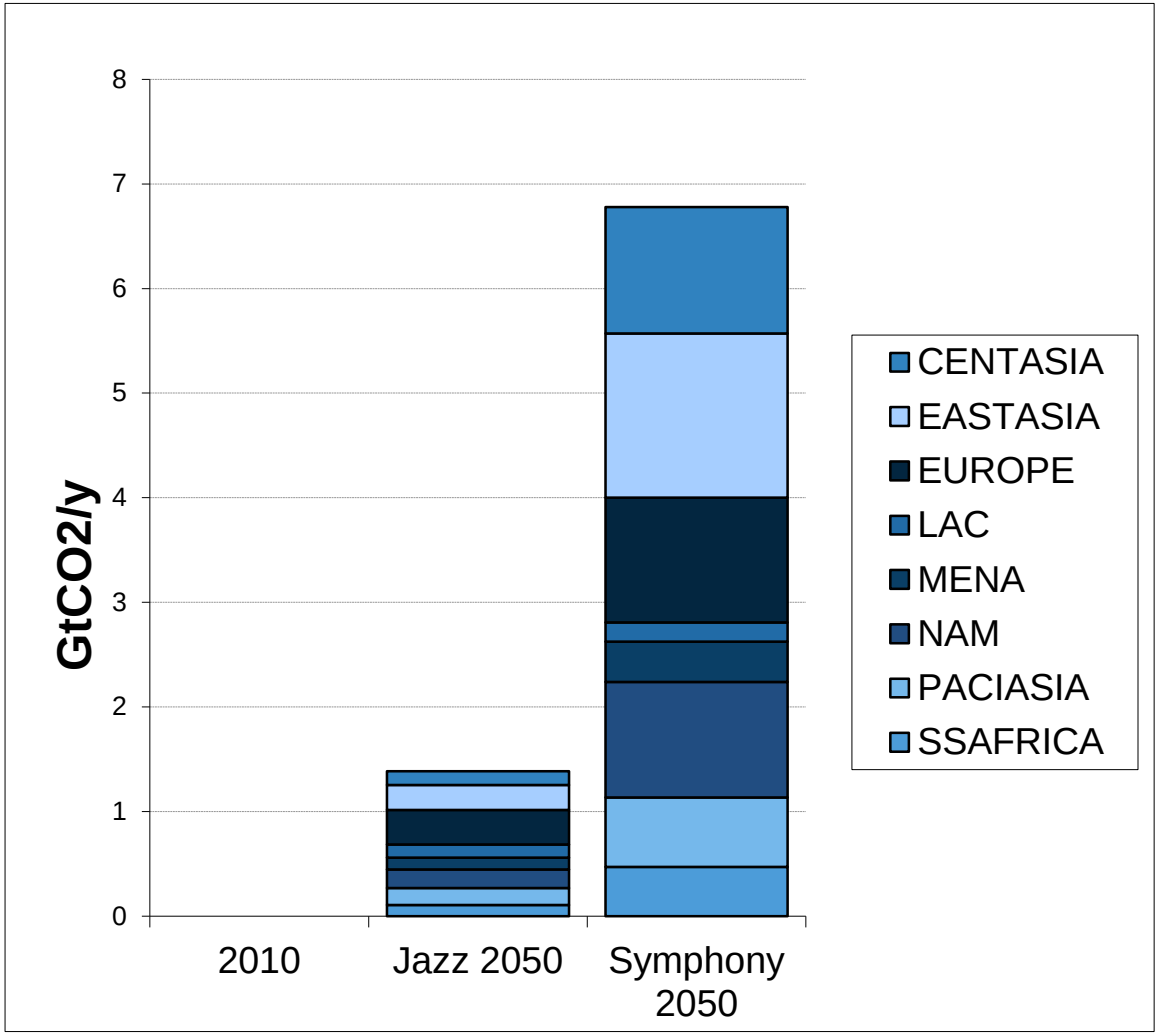
Source: World Energy Council, World Energy Scenarios – Composing energy futures to 2050, London, October 2013

Resultierende CO_2 Emissionen im IPCC Kontext



The global economy will be challenged to meet the 450 ppm target without enormous economic costs

Carbon Capture, Utilization and Storage



JAZZ:

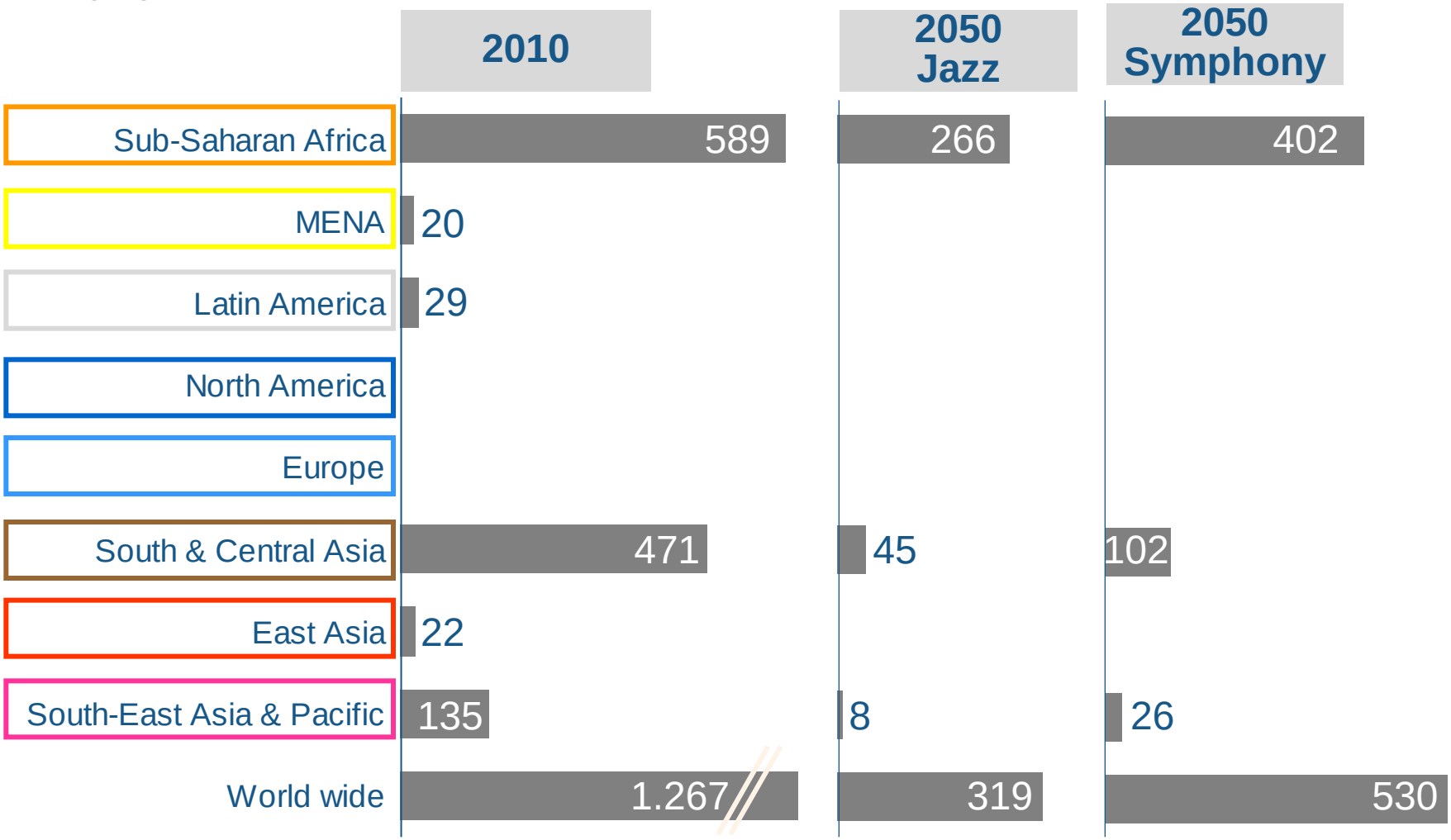
- Possibly ready at commercial scale 2035
- CC(U)S not adopted initially due to high costs/low carbon price
- Commercial use in enhanced oil recovery
- Wider adoption post 2040

SYMPHONY:

- Entry of CC(U)S earlier due to govt. intervention; govt. promotion
- CC(U)S increasingly required on coal new build
- CC(U)S in enhanced oil recovery

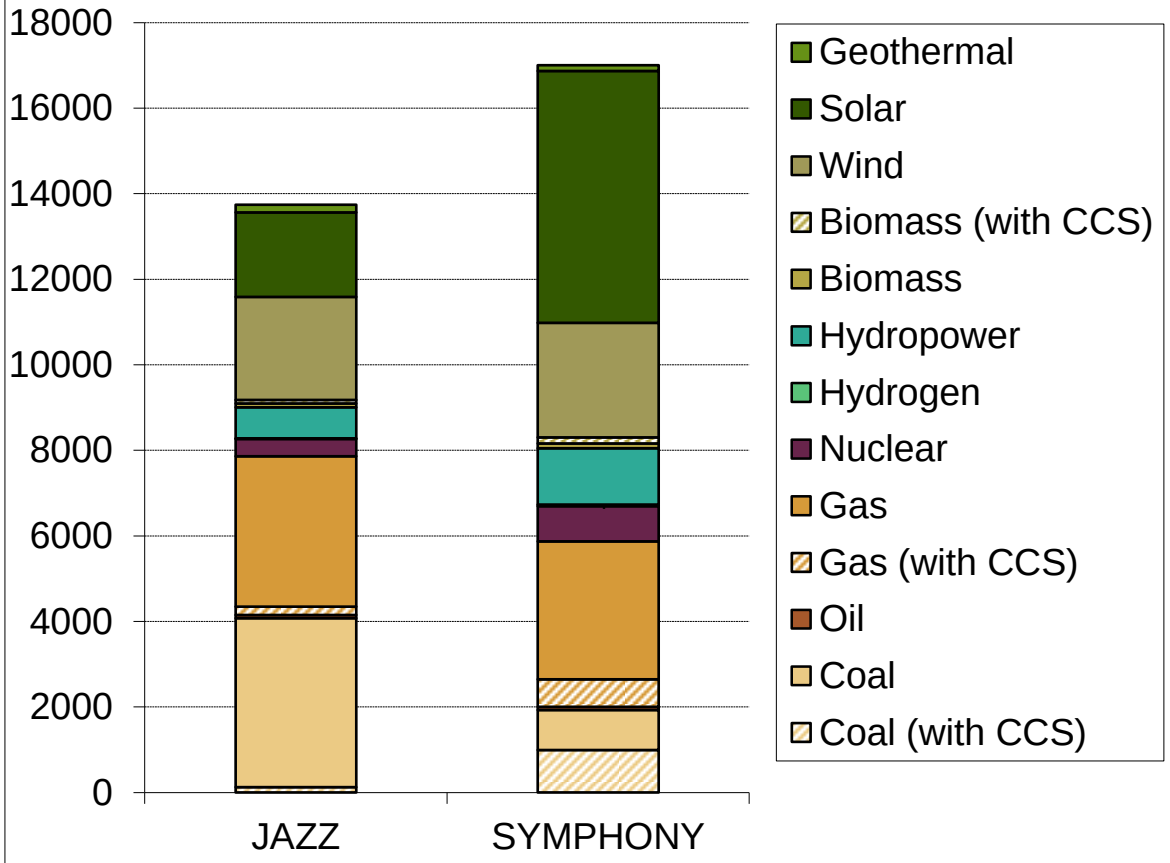
Bevölkerung ohne Zugang zu Energie

millionen



Source: World Energy Council, World Energy Scenarios – Composing energy futures to 2050, London, October 2013

Globale Investitionen in Stromerzeugung Kumulativ 2010-2050 in GW



Symphony cumul. undiscounted investment:	**25.7**	**trillion US$2010**
Jazz cumul. undiscounted investment:	**19.3**	**trillion US$2010**

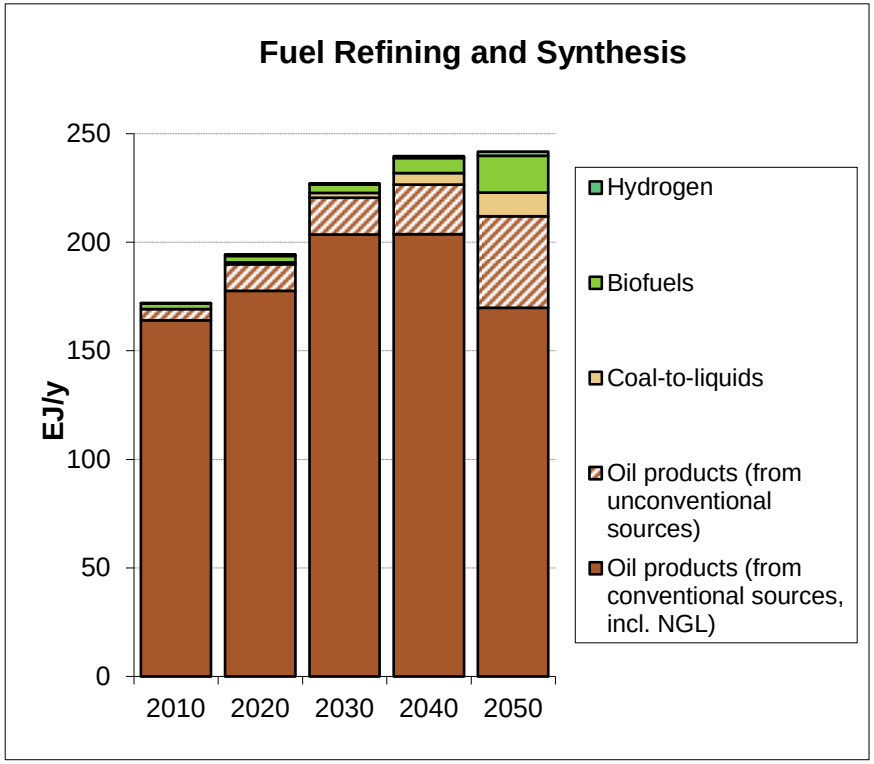
JAZZ:

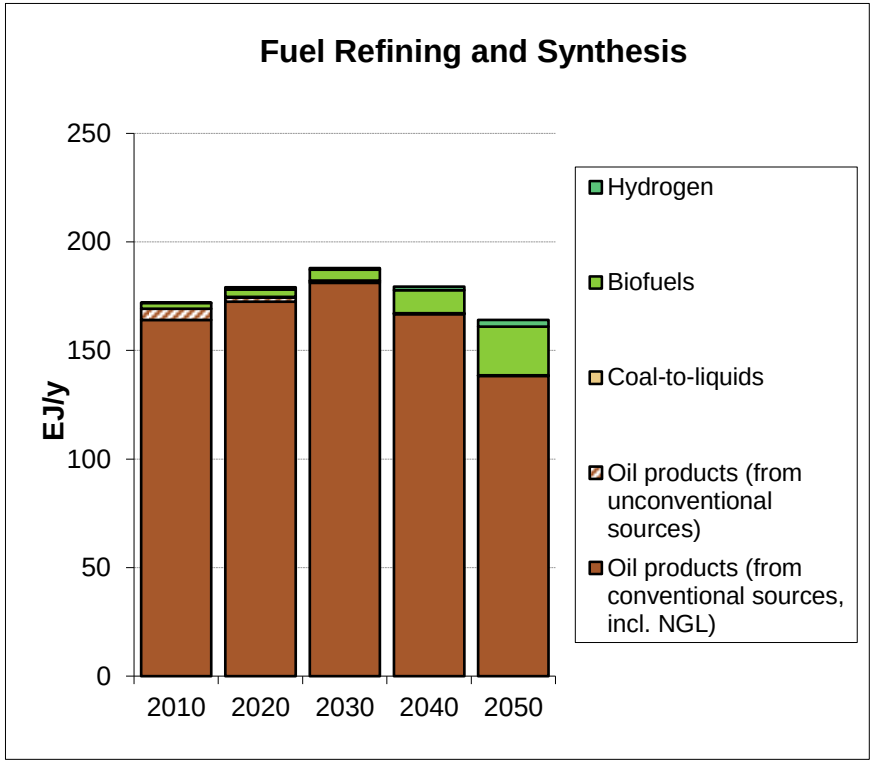
Approximately US$19.3 trillion (US$2010)

SYMPHONY:

Approximately US$25.7 trillion (US$2010)

Zukunft der Kraftstoffe





Jazz

Total refined fuels increase by 40%

Significant oil products from unconventional sources and coal to liquids as well as biofuels

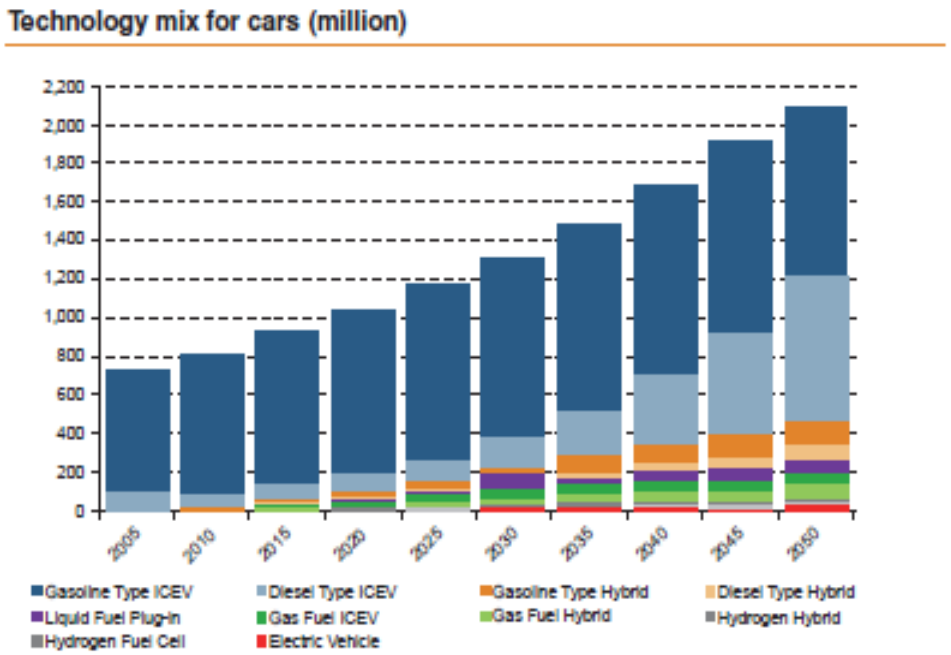
Symphony

Total refined fuels decrease by 5%

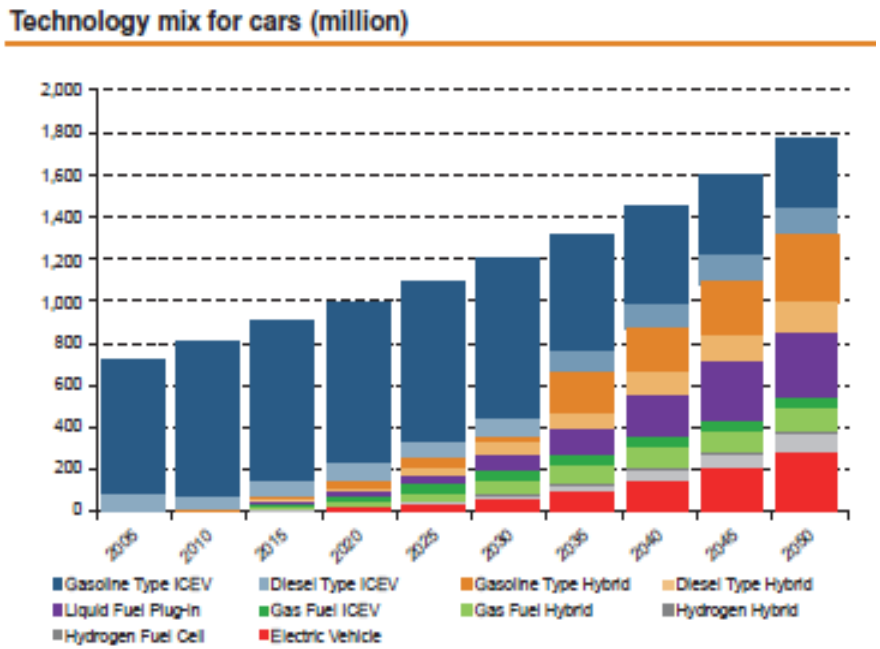
More biofuels and no coal to liquids or oil products from unconventional sources

19

Resultate für den Transportsektor



Jazz



Symphony

Conv. ICEVs share drop 98% to 26%-78%

Source: World Energy Council, World Energy Scenarios – Composing energy futures to 2050, London, October 2013

Energiemix in 2050

- **Coal** remains a dominant fuel (especially in China and India), some potential for coal to liquids (CTL), increasing challenges around CCS
- **Natural gas** will gain more importance in the energy share
- **Oil** will continue to be the dominant fuel in transport
- **Nuclear** is not a game changer
- **Hydro**: great economic potential of hydro electricity generation especially in SSA and LAC
- Share of **renewables** (RES-E) could be increased
- **Energy efficiency** and energy conservation are absolutely crucial in dealing with demand outstripping supply

Botschaften

- Verbrauch verringert sich nicht
- Der Druck und die Herausforderungen um das Energiesystem weiterzuentwickeln und zu transformieren sind enorm.
- Die Nachfrage nach fossilen Energien wird in absoluten Zahlen weiterhin steigen.
- Märkte und Geschäftsmodelle im Energiesektor ändern sich massgeblich; jetzt und auch in Zukunft
- Komplexität des Energiesystems steigt
- Es ist kein “Peak Oil” in Sicht