GREENPEACE Briefing

Energy [R]evolution vs. IEA World Energy Outlook scenario

New set of scenarios takes climate crisis into account
World Energy Outlook (WEO) 2008 for the first time takes the climate crisis really into account and develops two alternative scenarios. The alternative scenarios – according to the IEA – will limit global mean temperature rise; in the case of the "550ppm– Scenario" to +3℃ and in the case of the "450ppm-Scenario" to +2℃. While Gr eenpeace welcomes this approach, the scenarios lack a long-term projection to 2050 and beyond. Both scenarios end in 2030 which makes it difficult to comment on their real climate impact.

IEA supports Kyoto +
The new WEO 2008 provides a set of policy measures to achieve its scenarios. Greenpeace welcomes the IEA recommendation to urgently agree to a global, post-2012 regime to reduce global energy related CO_2 emissions. The new World Energy Outlook reveals that subsidies for fossil fuels in non-oecd countries alone add up to some USD300 billion in 2007. The new WEO 2008 provides detailed chapters about climate and energy policies; however it is too early for Greenpeace to provide a detailed comment now.

Same economic development projections in Greenpeace and IEA scenarios
The Greenpeace Energy [R]evolution scenario takes the same global economic developments and population growth into account. Therefore the scenarios are directly comparable.

Untapped Energy Efficiency Potentials
Under the IEA reference scenario energy demand grows by 1.6% per year – or 45% by 2030, while the two alternative scenarios (550ppm and 450ppm) exploit some efficiency potentials. The 550 ppm scenario still assumes an increase of 1.2% per year, while the 450ppm scenario assumes an increase of 0.8% per year – 50% less than the reference scenario. The Greenpeace Energy [R]evolution Scenario achieves these efficiency results with the same economic development projections via stricter efficiency standards. While the power demand projections for 2030 in the 450ppm scenario and the Energy [R]evolution Scenario are almost exactly the same, the demand from the other sectors (heating, transport, industry) by 2030 are 13.2 % lower in the Greenpeace scenario.

The role of oil
The new WEO 2008 states that there will be no shortage of oil and gas within the next 30 to 40 years, but that there will be a lack of investment in new infrastructure to explore and process it. Greenpeace believes that the limiting factor for the expansion of oil and gas should not be resource availability but the impact of climate change. While the IEA projects a further increase of oil consumption in all scenarios, the Energy [R]evolution Scenario achieves an overall reduction by 2030 and a 50% reduction by 2050 compared to today's consumption level. Future investments should go into the efficient use of oil, rather than new exploration and refineries.

Nuclear power: Continues to be irrelevant
Compared to the IEA World Energy Outlook of the past years, the role of nuclear power has again been downsized. The reference scenario assumes that nuclear power – even if current plans for new build reactors go through – will lose market share significantly: from 15% today to 10% in 2030. However, the 550ppm and 450ppm IEA scenarios factor in a rather unrealistic uptake, which would require the grid connection of a new nuclear reactor every month until 2030. But the overall market share of nuclear power would still be a small fraction of the renewables share.

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Dangerous: Unproven technologies play a large role in IEA alternative scenarios
Both IEA alternative scenarios rely to a large extent on unproven technology. CCS plays an important role in both scenarios. To achieve the projected capacity in 2030, two or three new CCS power plants have to come online a month between now and 2030. Given that there are no commercial CCS power plants available on the market right now, Greenpeace believes it is dangerous to rely on a technology for climate protection which virtually does not exist yet. And it is still unclear if it will be available at all before 2030. The Greenpeace Energy [R]evolution Scenario achieves 20% higher CO_2 reductions than the WEO by 2030 without this unproven technology.

Renewables: IEA starts to recognize large potential – solar and wind still underestimated
While the IEA reference scenario still neglects the big developments in the renewable power sector, the two alternative scenarios show an increase in uptake. The Energy [R]evolution Scenario has twice as much renewable power generation in 2030 as the WEO reference scenario (14,000 TWh instead of 7,600 TWh). The IEA alternative scenarios come closer to the Greenpeace projection (9,500 and 11,700 TWh). But the role of solar photovoltaic systems and concentrated solar power plants are mostly neglected. The role of wind power increased compared to the last world energy outlook, but remains under-represented. In the IEA reference scenario new renewables such as wind and solar provide 4% of global electricity by 2030. In comparison, the Energy [R]evolution Scenarios took the projected growth rates of the renewable industry and the existing manufactory capacity into account, resulting in about 20% of the global electricity production coming from new renewables by 2030.

The Energy [R]evolution scenario achieves 20% more CO2 reduction by 2030
While even the most ambitious IEA scenario will result in 20% higher CO_2 emissions compared to 1990 levels and an emissions peak by 2020, this does not meet the demands of the IPCC. The Energy [R]evolution Scenario will result in an emissions peak in 2015 and by 2020, 5 billion tonnes of CO_2 less than the IEA's most ambitious 450ppm scenario. To evaluate the climate impact of the IEA´s 550ppm and 450ppm scenarios, a long term projection – at least till 2050 is needed, but both IEA scenarios end in 2030.

Investments
The IEA reference scenario would require USD13.6 trillion of investment in the power sector between 2006 and 2030. The Energy [R]evolution Scenario would require only 8% higher investments – USD14.7 trillion within the same timeframe – but will reduce 19% more CO_2 emissions by 2030.

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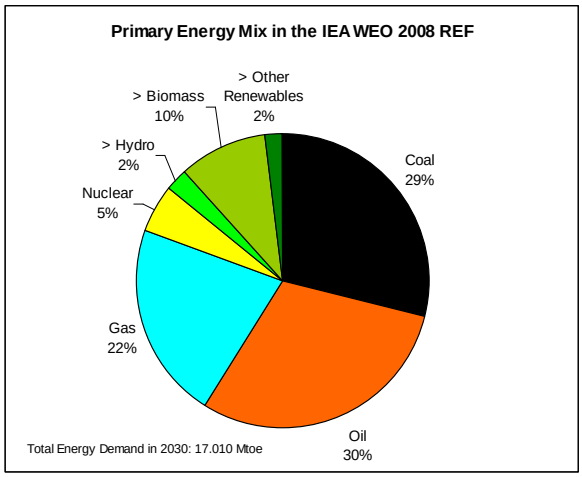
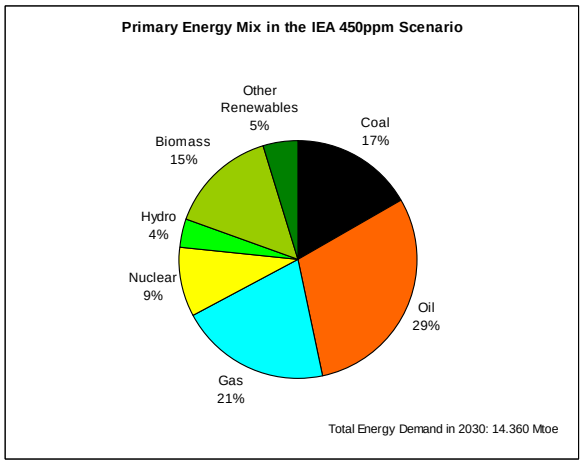
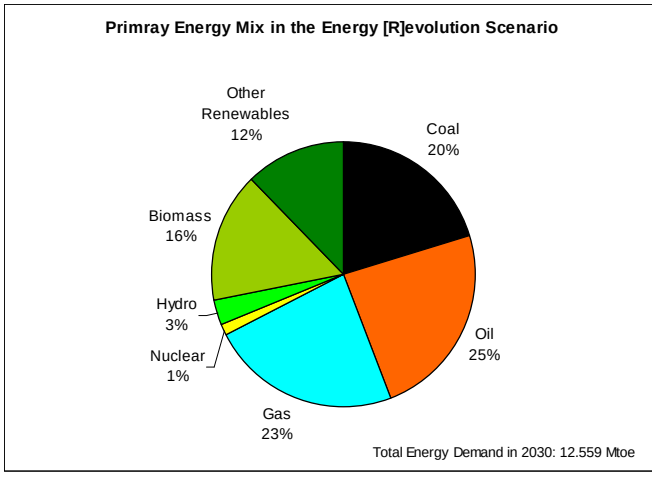
Results WEO 2008 versus E[R] 2008

Energy Mix

World energy demand in Mtoe by 2030 WEO 2008 vs E[R] 2008				
	IEA			Greenpeace
	REF WEO 2008	550ppm	450ppm	E[R] Mtoe
Coal	4.908	3.575	2.381	2.449
Oil	5.109	4.689	4.308	3.011
Gas	3.670	3.383	2.950	2.942
Nuclear	901	1.086	1.364	177
> Hydro	414	456	555	380
> Biomass	1.662	1.826	2.119	1.987
> Other Renewables	350	458	683	1.527
total RE	2.425	2.749	3.357	3.894
Total	17.014	15.483	14.360	12.473







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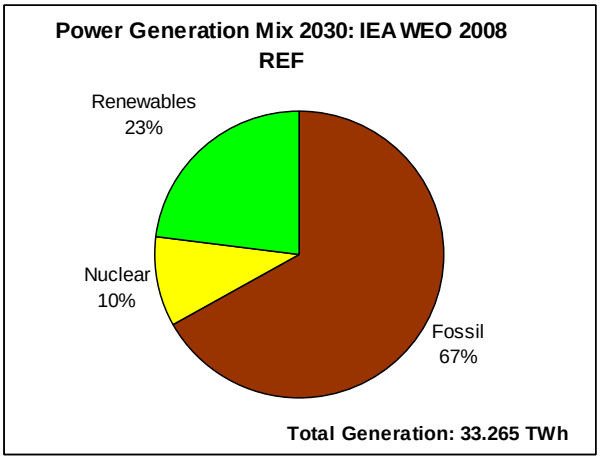
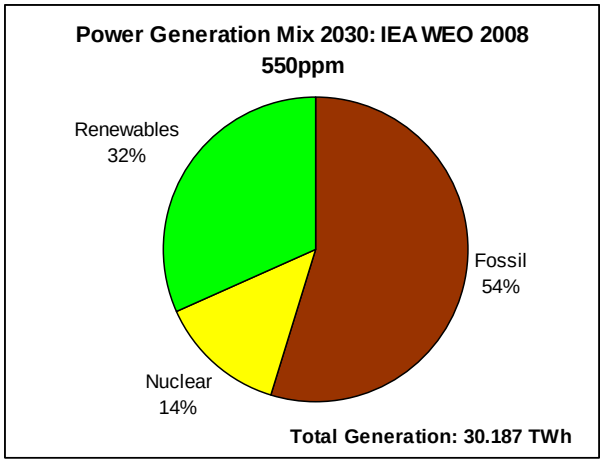
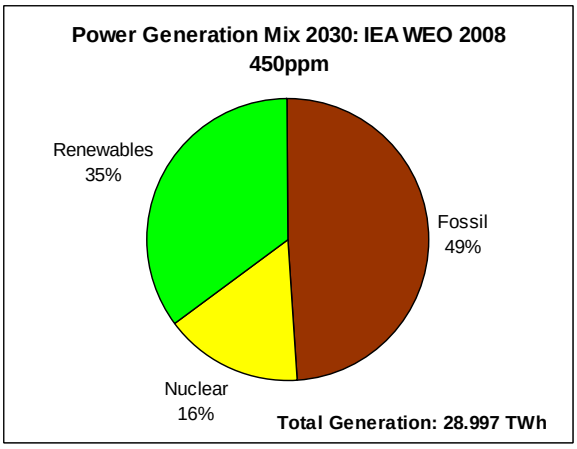
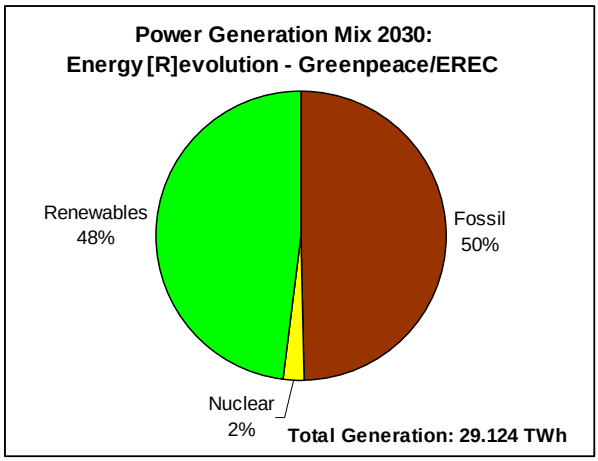
Electricity Mix

World energy electricity in TWh by 2030 WEO 2008 vs E[R] 2008				
	IEA			Greenpeace
	REF WEO 2008	550ppm	450ppm	E[R]
Coal	14.637	9.757		7.784
Oil	665	674	16.224	325
Gas	6.986	6.056		6.335
Nuclear	3.327	4.166	5.200	678
Renewables	7.651	9.534	11.697	14.002
Total	33.265	30.187	28.997	29.124









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The role of CCS in different scenarios

> IEA REFERENCE 2008:

In the IEA WEO 2008 reference scenario CCS power plants play a very minor role within the coal power generation. The average efficiency level of coal power is projected to go up slightly, but will still lead to significantly higher CO_2 emissions.

> IEA - 550ppm scenario:

A significant portion of this scenario's CO_2 savings come from CCS power plants. In order to achieve the CO_2 savings, the installed capacity must rise from virtually "zero" today to up to 162 GW of CCS power plants in 2030. Due to the fact that currently no CCS power plants are commercially available, this assumption looks quite unrealistic.

> IEA - 450ppm scenario:

Compared to the 550ppm scenario, the CCS capacity more than doubles to 363 GW of CCS power plant capacity by 2030. This would account for 9% of fossil fuel based electricity generation or roughly 5% of global electricity generation. Again, this seems to be very unrealistic both in technical and economical terms.

> Greenpeace – Energy [R]evolution:

The Greenpeace Energy [R]evolution scenario does not use CCS power plants at all, as this is an unproven technology. Instead, this scenario introduces the efficient use of fossil fuels in co-generation power plants. The overall use of coal decreases significantly, the amount of gas used in the electricity generation increases slightly until 2030 and decreases again back to today's level by 2050.

The role of nuclear power in different scenarios

> IEA REFERENCE 2008:

According to the new IEA WEO 2008 reference scenario, nuclear power plants continue too lose importance. The share of nuclear power within the electricity mix drops from today's 15% to 10% in 2030. On a global level 28,000 MW are listed as "under construction". Even in the unlikely case that all these projects are completed and connect to the grid, this capacity is not enough to offset retirements and the raising demand.

> IEA - 550ppm scenario:

The IEA´s 550ppm scenario projects 251,000 MW of new build nuclear power plants by 2030. To achieve this, between now and 2030, a new nuclear power plants needs to start electricity production every month. In the light of the experiences with the last IPR constructions in Finland and France with delays of several years and serious budget overruns – this seems rather unrealistic. But even if this would work, it would not even keep the nuclear electricity share at today's level of 15% but it would drop slightly to 14%.

> IEA 450ppm scenario – approx three new reactors every months until 2030

The IEA´s 450ppm scenario projects 680,000 MW of new build nuclear power plants by 2030. To achieve this, between now and 2030, between two and three new nuclear power plants needs to start electricity production every month.

> Greenpeace – Energy [R]evolution:

Nuclear power will be phased out to a large extent by 2030 in the Greenpeace scenario and no new nuclear plants will be built. Only 2% of the World's electricity will come from nuclear power – mainly from power plants that came online in the past few years.

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The role of renewable power in different scenarios

> IEA – REFERENCE 2008:
While the share of nuclear power is on its way down in the new IEA Reference scenario, renewables continue to grow and increase their share from today's 18% to 23% in 2030 – even under the assumption that global electricity demand increases by more than 50% in this timeframe.

> IEA - 550ppm scenario:
Renewable energy will double its share in this scenario from 15% today to 30% in 2030. While there is a sharp increase of hydro power plants, wind power is compared to the Greenpeace scenario, underestimated. The 550ppm uses less than half of the wind power capacity of the Greenpeace scenario.

> IEA - 450ppm scenario:
Renewable power will provide 40% of the global electricity by 2030 in this scenario - compared to the Greenpeace scenario which calculates 50% by 2030. Given the fact that both scenarios have almost exactly the same electricity demand for 2030, the 450ppm scenario generates the "missing" 10% with CCS and nuclear instead.

> Greenpeace – Energy [R]evolution:
Renewable power generation will play a major role in the Energy [R]evolution Scenario. By 2030 almost half of the global electricity supply will come from new renewable energy sources.

Investments in the power sector:
The IEA WEO 2008 Reference scenario projects US$13.6 trillion between 2006 and 2030. The Greenpeace Energy [R]evolution scenario costs US$14.7 trillion – so only 8% more, but will reduce 19% more CO_2 emissions by 2030.

CO2 emissions

WEO 2008:	Reference Scenario:	total CO2 emissions: 41 Gt by 2030
WEO 2008:	Reference Scenario:	per capita CO2 emissions: 4.9 Gt by 2030
WEO 2008:	550ppm Scenario:	total CO2 emissions: 33 Gt by 2030 (peak in 2025)
WEO 2008:	550ppm Scenario:	per capita CO2 emissions: 3.9 Gt by 2030
WEO 2008:	450ppm Scenario:	total CO2 emissions: 25.7 Gt by 2030 (peak in 2020 – 32.5 Gt)
WEO 2008:	450ppm Scenario:	per capita CO2 emissions: 3.0 Gt by 2030
Energy [R]evolution Scenario 2008:		total CO2 emissions: 20.9 Gt by 2030 (peak in 2015 – 27.5 Gt)
Energy [R]evolution Scenario 2008:		per capita CO2 emissions: 2.5 Gt by 2030

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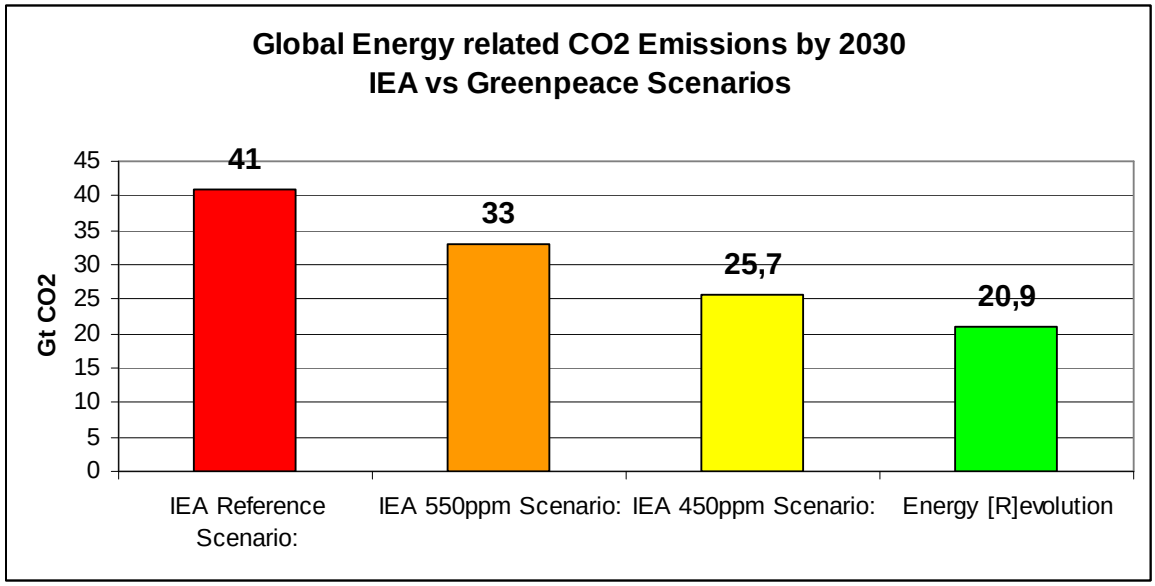

Key parameters IEA World Energy Outlook VS Energy [R]evolution

Population development

WEO = E[R] 2008 (same)

GDP development

WEO = E[R] 2008 (same)

Oil Price assumptions:

WEO 2008: 2030: 122$/barrel (real)
E[R] 2008: 2030:120 $/barrel (real)

Coal price

WEO 2008: 2030: 206$/tonne (real)
E[R] 2008: 2030: 251$/tonne (real))

Electricity generation costs

- Renewables

WEO = E[R] 2008 > high differences between technologies, but all are within the same range +/- 20 %

- Fossil Fuels

WEO = E[R] 2008 > approx 15ct/kWh in 2030 both are within the same range +/- 20 %

- Nuclear Power

WEO = assumes generation costs between 5 and 8 ct/kWh in 2030 VERY UNREALISTIC

Average lifetime for power plants

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Renewable energies (Solar, Wind etc)
WEO = E[R] 2008 (approx. 20 years – Hydro 60 years)

Fossil fuel power plants (gas + coal)
WEO 2008: Gas = 25 years / Coal = 50 years
E[R] 2008: Gas = 40 years / Coal = 40 years

Nuclear power plants (gas + coal)
WEO 2008: = 50 years
E[R] 2008: = 30 years

Average energy efficiency

WEO 2008:	Reference Scenario:	+ 1.6%/a (2006-2030)
WEO 2008:	550ppm Scenario:	+ 1.2%/a (2006-2030)
WEO 2008:	450ppm Scenario:	+ 0.8%/a (2006-2030)
Greenpeace/EREC:	Energy [R]evolution Scenario:	+ 0.5%/a (2006-2030)

Details for E[R]:
E[R] 2008: Energy [R]evolution Scenario. 2006 – 2020: + 13% or approx + 1 % per year
E[R] 2008: Energy [R]evolution Scenario. 2021 – 2030: - 3% or approx – 0.3 % per year
E[R] 2008: Energy [R]evolution Scenario. 2006 – 2030: + 10% or approx + 0.5 % per year

Key parameters IEA World Energy Outlook VS Energy [R]evolution

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WEO = E[R] 2008 (same)

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