

Energy [R]evolution vs. IEA World Energy Outlook scenario 2011

Sven Teske – Greenpeace International

IEA Scenarios – an overview

The IEA has changed their scenario structure over the past three years significantly. The following table provides an overview about the changes of the IEA WEO over the past three years:

Scenarios in WEO 2009:

- 1) Reference - projection under unchanged policy conditions
 - 2) 550ppm – “climate protection light” a projection with some minor climate and energy policy changes; the result would still be disastrous for the climate
 - 3) 450ppm – projection with significant changes in climate and energy policy, but still not enough to avoid dangerous climate change
- Both, the 550ppm and the 450ppm scenario end in 2035 – for long term climate impacts the projection must go to 2050 at least.

Scenarios in WEO 2010:

- 1) Current policy - the new-name of “reference” scenario reflects that unchanged policy is not an option and certainly not a “reference” for policy makers.
- 2) New Policy – the 550ppm scenario has been dropped as climate science clearly showed that 550ppm CO₂ in the atmosphere will have a severe impact to the world’s climate. Instead, the IEA presented a new scenario which takes announced policy changes into account.
- 3) 450ppm – projection with significant changes in climate and energy policy, but still not enough to avoid dangerous climate change

Scenarios in WEO 2011:

- 1) Current policy – renewable energy (RE) projections have been increased.
- 2) New Policy – remarkably the (Carbon capture and storage) CCS technology has almost been dropped under this scenario, as it projects that only 1% of the total fossil fuel capacity will be equipped with CCS by 2035.
- 3) 450ppm – projection close to WEO 2010 however RE projections have been increased significantly, nuclear projections decreased again. CCS as a “low GHG technology” has been scaled back significantly and does not play a role as important as in the last edition.
- 4) Low Nuclear case – the IEA is beginning to accept the reality that the nuclear industry is not able to deliver due to massive security issues, nuclear waste problems as well as significant delays and cost overruns in new nuclear power plant projects such as in Finland and France.

Due to the Fukushima catastrophe, many more governments around the world are starting to phase out nuclear energy, so aggressive nuclear growth scenarios become untenable with no basis in the real world.

“IEA has been driven by political agendas to keep a prominent role of nuclear power and CO₂-capturing coal power plants in its scenarios, despite their obvious failure to deliver against false expectations. Although in the past four to five years, each new WEO edition somewhat increases its projections for renewables and downscales its projections for “false hope technologies” such as CCS and nuclear, it still plays the tune of unrealistic nuclear growth scenarios and unjustified horror scenarios of increased costs and greenhouse gas emissions in the case of a nuclear phase-outs”, says Sven Teske, senior energy expert Greenpeace International.

Overview – Technology Projections:

Renewables: The IEA increases again projections in renewable energy

The IEA increases the RE projections for 2030 in the “450ppm” compared to the last WEO 2010 edition by approx 600 TWh/a in each scenario, with a further increase of another 30% or about 3000 TWh/a five years later. The 450ppm scenario projects for 2035 a RE generation of 15,062 TWh/a - slightly higher than the Greenpeace basic Energy [R]evolution projection for 2030 (14,400 TWh/a), but still 30% under the advanced Energy [R]evolution projection. The role of solar photovoltaic systems and concentrated solar power plants are still neglected or played down. The installed capacity of wind power increased again compared to the last world energy outlook. The “New Policy” scenario would lead to a renewable electricity share of 30%, and 46% in the “450ppm” scenario by 2035. 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 61% of the global electricity production coming from new renewables by 2030.

	IEA World Energy Outlook 2010			IEA World Energy Outlook 2011			Low Nuclear Case	Greenpeace	
	Current policies (Reference)	New Policies	450ppm	Current policies (Reference)	New Policies (figures calculated)	450ppm		basic E[R]	adv E[R]
Coal	14.784	11.160	6.269	15.110	11.616	5.943		7.564	5.032
Oil	625	529	391	603	547	394		350	339
Gas	7.419	7.032	6.012	7.631	7376	6.226	16.941	6.883	5.921
Nuclear	3.992	4.520	5.737	3.938	4337	5.582	2.470	802	765
Renewables	7.896	9.455	11.761	8.185	9.540	12.247	12.805	14.517	18.827
Total 2035	34.716	32.696	30.170	35.468	33.417	30.393	32.216	30.133	30.901

Electricity generation in TWh/a	Current policies (Reference)	New Policies	450ppm
	2035	2035	2035
OECD - Total	13.939	13.304	12.541
Fossil fuels	7.713	6.165	3.285
Nuclear	2.471	2.779	3.463
Renewables	3.755	4.360	5.793
Non-OECD - Total	25.429	22.946	19.683
Fossil fuels	18.463	14.327	7.481
Nuclear	1.582	1.879	2.932
Renewables	5.384	6.740	9.269
World - Total	39.368	36.250	32.224
Fossil fuels	26.176	20.492	10.766
Nuclear	4.053	4.658	6.395
Renewables	9.139	11.100	15.062

Renewables Power Installed capacities					
	WEO 2010 - New policy scenario -	WEO 2011 - New policy scenario -	WEO 2011 - 450ppm -	basic ER2010	advanced ER2010
Installed capacity in 2035					
Wind in [GW]	1035	1102	1685	1733	2241
Solar Photovoltaic in [GW]	406	499	901	1036	1330
Concentrated Solar Power in [GW]	91	81	226	324	605
Renewable electricity share in 2030/2035	32%	30%	46%	48%	61%

“The IEA has a long tradition to under estimate renewable energy and over estimate nuclear. This year, once again, the IEA projections are significantly under those of the renewable industry and Greenpeace which have proven to be right over the past years. I am confident that the WEO in 2015 will finally acknowledge that inevitable dominance of renewable energy– combined with energy efficiency – is also the only practical way forward to protect our climate, to provide access to energy for the poor at affordable costs, and to achieve secure energy supply immune to volatile fossil fuel markets”, says *Sven Teske, senior energy expert Greenpeace International*.

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Nuclear power: Continues to be irrelevant in the “New Policy” scenario

The “New Policy” scenario – even after the nuclear disaster in Fukushima – projects an unrealistic uptake from 398 GW in 2009 to 640 GW¹ in 2035, which would require the grid connection of one new nuclear reactor every six weeks between today and 2035. However the current status of the nuclear industry shows a very different picture. According to the IAEA (3rd November 2011) 433 nuclear power reactors are in operation with a total net installed capacity of 367 GW – so the installed nuclear capacity decreased compared to the base year of the scenario (2009) already by 31 GW. Even with this almost 10% decrease of the global nuclear capacity over the past 2 years, the IEA still projects almost a doubling of the nuclear capacity within the next 33 years. In the light of the disastrous experience of the construction of Areva’s EPR in Finland and France, which have seen years of delays, thousands of technical problems, many billions dollars in costs overruns, the IEA projection seems absurd and contradicts the second IEA scenario of a “low nuclear case”.

The “low nuclear case” scenario: False information about the effects of a nuclear phase-out

For the first time, the IEA has done a “low case” nuclear scenario which still does not reflect the realities of nuclear phase-out decisions from countries like Germany or Belgium correctly. According to the “low case” nuclear scenario, the installed capacity would go down from currently 367 GW to 339 GW in 2035. Given the average age of functional commercial nuclear reactors is 27 years and approach retirement within the next two decades, while only a limited number of reactors are currently under construction, it seems very unrealistic that the overall nuclear capacity will only go down by only 28 GW.

Simplistic and unrealistic assumptions

The replacement strategy under the “low nuclear case” to fill the nuclear “gap” with 33% coal, 33% gas and 33% renewables is neither realistic, nor practicable. Countries phasing out high nuclear installed capacities, such as Germany, are not going to replace them with coal, but with a mix of gas, RE and efficiency. A regional analysis is not available from the IEA

The Implication of less nuclear power? A faster uptake of renewables!

The IEA claims that the overall investments in power plants would increase by 9% under the “low case nuclear” scenario, but it doesn’t reveal their cost estimates for renewable power plants, nor does it factor in the fuel cost savings. With a coherent renewable energy and efficiency strategy – shown in the Greenpeace Energy [R]evolution scenario – a nuclear phase-out would neither increase energy costs nor carbon emissions.

“The IEA is once again putting politics ahead of science by suggesting that reduction in nuclear power will lead to higher energy costs and emissions – the opposite is the case, A combination of energy efficiency and renewables would be the way forward and could lead to a complete phase-out of nuclear power by 2035, while lowering electricity costs and carbon emissions,”. says Sven Teske, senior energy expert Greenpeace International.

¹ Gross capacity

The IEA still sticks to Coal

Coal accounted for almost half of the increase in global energy use over the past decade. The IEA's "New Policies" Scenario, global coal use rises through to the early 2020s and then on this level throughout the rest of the projection period and would be about 25% higher than in 2009. In all IEA projections, Coal continues to be the second-largest primary fuel globally and the backbone of electricity generation. In the Current Policies Scenario, demand continues to rise even after 2020, increasing overall by more than 60% to 2035. However in the 450 Scenario coal demand peaks before 2020 and decrease afterwards to about one-third between 2009 and 2035.

China is responsible for almost 50% of global coal use in 2009 and is seen to remain the main market for coal expansion. In the New Policies Scenario, China accounts for more than 50% of global coal demand growth, with its demand growing around one-third by 2020 and then declining slightly before remaining broadly stable through to 2035.

Also India also plays an increasingly important role and the coal use is projected to more than double by 2035. In the IEA's "New Policies" Scenario, India even displaces the United States of America as the world's second largest coal consumer by 2025 as the IEA sees coal as a source to increase access to energy for the poor in India.

In both the IEA "New Policies" and "Current Policies" Scenarios the increase power demand remains for the expansion of coal power plants globally.

While the IEA still states that "...Stronger uptake of existing clean coal technologies and carbon capture and storage, could boost the long-term prospects for coal use" – the use of Carbon Capture and Storage technologies (CCS) does not play a significant role in neither of they scenarios.

"The IEA's projections for coal expansion – especially in China and India – draw a very dark picture for the climate and the future development of a sustainable energy supply. We need to phase-out coal in all countries – including China and India – or we will not be able to avoid dangerous climate change. The IEAs assumption, that coal can ease the access to energy problem in developing countries is a false assumption, as only renewables can deliver fast and clean access to energy," says Sven Teske, senior energy expert Greenpeace International.

IEA: Grid Integration of wind and solar power plants are not a significant cost factor.

While the IEA still underestimates the deployment potential of renewables in their “New Policy” scenario, the IEA clearly states that integration of renewables in the grid is not at all a major cost factor. Only 3% of the overall infrastructure investment costs needed to implement the “New Policy” scenario in 2035, while 57% of the investment will flow to grid expansion worldwide and the remaining 40% for refurbishment of existing grids.

However the IEA still focuses on centralized power generation which requires more grid capacity than decentralized energy. New technology options, which allow the transport of more capacity with existing power lines such as the conversion from AC overhead power lines to DC operation are not included in this analysis. Therefore the presented infrastructural costs may be far lower and the cost effectiveness of decentralized renewables is not even mentioned in the report.

“The IEA still focuses on centralized power generation which requires more grid expansion and therefore more investment in new grids while decentralized renewable power generation and new innovative grid concepts are still underestimated. One new technology development – such as the conversion of AC power lines to DC operation - which doubles transmission capacity without a single new power tower - are not even part of the analysis. Greenpeace asks the IEA to be more open to new innovative grid concepts for the smart use of renewables,” says Sven Teske, senior energy expert Greenpeace International.

Subsidizing climate change and access to energy

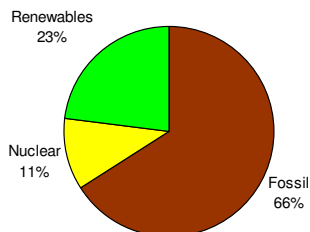
The IEA analysis indicates that subsidies in fossil fuels are still growing and that they have reached \$409 billion in 2010 – about \$110 billion or almost 25% higher than in 2009. The IEA warned that without further reform, spending on fossil fuel consumption subsidies is set to reach \$660 billion in 2020, or 0.7% of global GDP. Greenpeace welcomes the IEA initiative to highlight subsidies in climate destruction and urges governments around the world to phase-out subsidies within the next few years. Redirecting fossil fuel ALL subsidies to “access to energy programs” would triple the global renewable energy market and would drive down the costs for renewables even faster. Lower costs for renewables would lead to faster emissions reduction and to a faster access to energy for the poor.

The IEA states that an investment of USD 48 billion per year is needed to provide energy to the 1.5 to 2 billion people who currently have no access to energy services by 2030. This represents only 11.7% of the current fossil fuel subsidies. Redirecting all fossil fuel subsidies to renewable programs would accelerate the access to energy programs significantly.

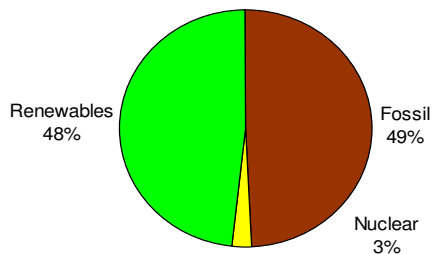
“Subsidizing fossil fuels means subsidizing climate destruction. In 2010 the fossil fuel subsidies where twice as high than the total renewable energy market, The US\$ 400 billion fossil fuel subsidy would buy enough renewable energy capacity to supply the entire power demand of all African countries. We support the IEA in the call to stop this fossil fuel subsidy madness but we are surprised that the IEA only identifies US\$ 48 billion annual investment needs for energy access programs. By simply redirecting all the fossil fuel subsidies to renewable energy programs the 2 billion poor people would have access to energy not only by 2030, but within this decade,” says Sven Teske, senior energy expert Greenpeace International.

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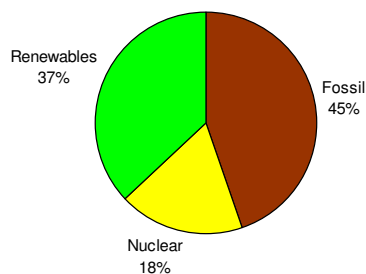
**Power Generation Mix 2030: IEA WEO 2011
"Current Policy"**



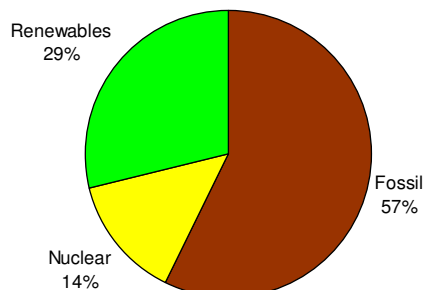
**Power Generation Mix 2030:
basic Energy [R]evolution - Greenpeace/EREC**



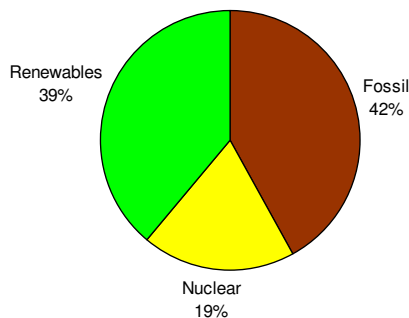
**Power Generation Mix 2030: IEA WEO 2009
"450ppm"**



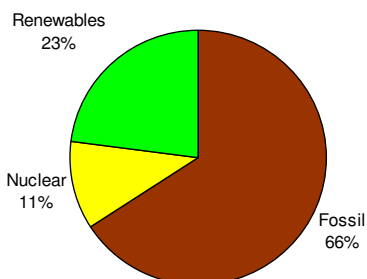
**Power Generation Mix 2030:
IEA WEO 2010 "New Policy"**



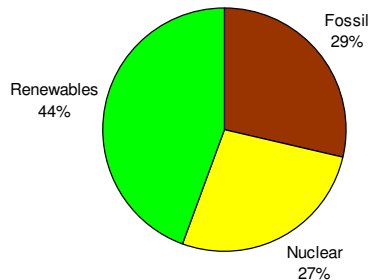
**Power Generation Mix 2030:
IEA WEO 2010 450ppm**



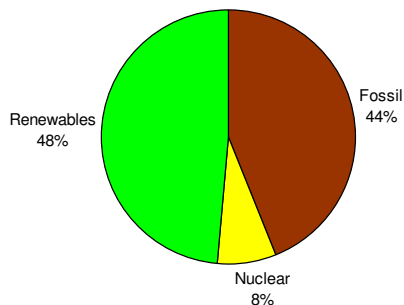
**Power Generation Mix 2030:
IEA WEO 2011 "New Policy"**



**Power Generation Mix 2030:
IEA WEO 2011 "450ppm"**



**Power Generation Mix 2035: IEA WEO 2011
"Low Nuclear Case"**



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

Population development

GDP development

WEO = E[R] (+/- 0.5%)

Oil Price assumptions:

WEO 2008: (REF)	2030: 122 \$/barrel
WEO 2009: (REF)	2030: 115 \$/barrel
WEO 2010: (Current policies)	2030: 130 \$/barrel
WEO 2011: (Current policies)	2030: 134,5 \$/barrel
E[R] 2010:	2030: 150 \$/barrel

Coal price

WEO 2010 (Current Policy):	2030: 112 \$/tonne
WEO 2011 (Current Policy):	2030: 116 \$/tonne
E[R] 2010:	2030: 142 \$/tonne

Fossil fuel power plants lifetime (gas + coal)

WEO 2010:	Gas = 40 years (CCGT) / 25 years (OCGT) / Coal = 50 years
WEO 2011:	Gas = 40 years (CCGT) / 25 years (OCGT) / Coal = 50 years
E[R] 2010:	Gas = 40 years / Coal = 40 years

Average energy efficiency (growth of primary energy demand)

WEO 2008:	Reference Scenario:	+ 1.6%/a (2006-2030)
WEO 2009:	Reference Scenario:	+ 1.5%/a (2007-2030)
WEO 2010:	Current Policy (REF)	+ 1.4%/a (2008-2035)
WEO 2011:	Current Policy (REF)	+ 1.6%/a (2009-2035)
WEO 2008:	450ppm Scenario:	+ 0.8%/a (2006-2030)
WEO 2009:	450ppm Scenario:	+ 0.8%/a (2006-2030)
WEO 2010:	450ppm Scenario:	+ 0.7%/a (2008-2035)
WEO 2011:	450ppm Scenario:	+ 0.8%/a (2009-2035)
Greenpeace/EREC 2010:	basic Energy [R]evolution Scenario 2010:	+ 0.5%/a (2007-2030)

Renewables Power Installed capacities

	WEO 2010 - New policy scenario -	WEO 2011 - New policy scenario -	WEO 2011 - 450ppm -	basic ER2010	advanced ER2010
Installed capacity in 2035					
Wind in [GW]	1035	1102	1685	1733	2241
Solar Photovoltaic in [GW]	406	499	901	1036	1330
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Renewable electricity share in 2030/2035	32%	30%	46%	48%	61%

CO₂ emissions

WEO 2008: Reference Scenario:	total CO ₂ emissions: 41 Gt by 2030
WEO 2009 Reference Scenario:	total CO ₂ emissions: 40.2 Gt by 2030
WEO 2010 Current Policy Scenario:	total CO ₂ emissions: 40.01 Gt by 2030
WEO 2011 Current Policy Scenario:	total CO ₂ emissions: 43.3 Gt by 2030
WEO 2008: 450ppm Scenario:	total CO ₂ emissions: 25.7Gt by 2030 -peak 2020 32.5Gt
WEO 2009: 450ppm Scenario:	total CO ₂ emissions: 26.4Gt by 2030 -peak 2020 30.9Gt
WEO 2010: 450ppm Scenario:	total CO ₂ emissions: 24.90Gt by 2030 -peak 2020 32.0Gt
WEO 2011: 450ppm Scenario:	total CO ₂ emissions: 24.78Gt by 2030
Basic Energy [R]evolution 2010:	total CO ₂ emissions: 21.9Gt by 2030 -peak 2015: 28.8 Gt
Advanced Energy [R]evolution 2010:	total CO ₂ emissions: 18.3Gt by 2030 -peak 2015: 28.4

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