

Energy [R]evolution 2012

A sustainable World Energy Outlook to save the climate, reduce fossil-fuel dependence and create more employment

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The new Energy [R]evolution Scenario 2012 provides a practical pathway for significantly reducing CO₂ emissions from transportation, and ending the exploitation of marginal and unconventional sources of oil, such as the Arctic, the tar sands in Alberta, Canada and off shore oil in Brazil.

If implemented, the pathway would protect the world from catastrophic climate change by phasing out fossil fuels while ensuring energy security for growing economies and populations. The Energy [R]evolution Scenario, first published for Europe in 2005, is a well-respected energy analysis. The 2012 version is the fourth Global Energy [R]evolution scenario; earlier editions were published in 2007, 2008 and 2010.

New features of the Energy [R]evolution 2012 Scenario

- Details on the enhanced uptake of renewable energy. Installation of renewable energy in 2011 was more than 50% higher than estimated in the first Energy [R]evolution report;
- Details on how the installed capacity of renewable energy will grow to 7,392 GW in 2030 from 237 GW in 2011;
- For the first time, the scenario includes an analysis of the decline in conventional fossil fuel reserves and a detailed scenario for phasing out oil use, with no need for oil from the Arctic, the tar sands, off shore drilling in Brazil or other marginal sources;
- An analysis of how efficiency measures can cut electricity demand by 30% compared to the expected increase;
- An analysis of how efficiency measures can cut energy demand for heating by 20% compared to the reference case;
- A scenario for how renewable energy can provide energy for the two billion people in the world now without access to energy;
- A target of reducing CO₂ emissions by 80% in 2050 from 1990 levels.

Climate change threats

The threat of climate change, caused by rising global temperatures, is the most significant environmental challenge facing the world with major implications for social and economic stability, natural resources and the production of energy. In order to avoid the most catastrophic impacts of climate change, global greenhouse gas emissions must peak by 2015 and then fall rapidly to keep the global temperature increase as far below 2°C as possible.

Even if warming reaches 1.5°C, increases in drought, heat waves and floods, increased water stress for up to 1.7 billion people, and more frequent wildfires are projected in many regions. To keep rising temperatures to acceptable limits, we need significant reductions in our greenhouse gas emissions. This makes both environmental and economic sense. This is still possible, but time is running out. The 2012 Energy [R]evolution provides the scenario for avoiding the worst impacts of climate change.

Climate change and security of supply

The 2012 E[R] shows the days of “cheap oil and gas” are coming to an end. Uranium to fuel nuclear reactors is also a finite resource. In contrast, the global reserves of technically accessible renewable energy are large enough to provide in excess of 40 times more energy than the world currently consumes, forever, according to the latest IPCC Special Report Renewables (SRREN).

Cost reductions in just the past two years have fundamentally changed the economics of renewables, especially for wind and solar photovoltaics. All renewable energy sources produce little or no greenhouse gases and are a virtually inexhaustible 'fuel'. Some technologies are already competitive; the solar and the wind industries have maintained double-digit growth rates for over 10 years now, leading to faster technology deployment worldwide.

Energy efficiency offers the most cost-competitive way to reform the energy sector with enormous potential for reducing energy consumption, while providing the same level of energy services. New business models to implement energy efficiency must be developed and must get more political support.

The fossil fuel dilemma

Rising energy demand is putting pressure on fossil fuel supply and now pushing oil exploration towards marginal and unconventional oil resources, such as the Arctic, and the environmentally destructive tar sands project in Canada.

More important than oil scarcity and exploiting marginal oil is the need cut emissions to save the planet's climate. In addition, The Energy [R]evolution 2012 shows the substantial benefits of switching from fossil fuels to renewables — independence from world market fossil fuel prices, millions of new green jobs and energy for the two billion people currently without access to energy.

The off oil pathway of the new Energy [R]evolution

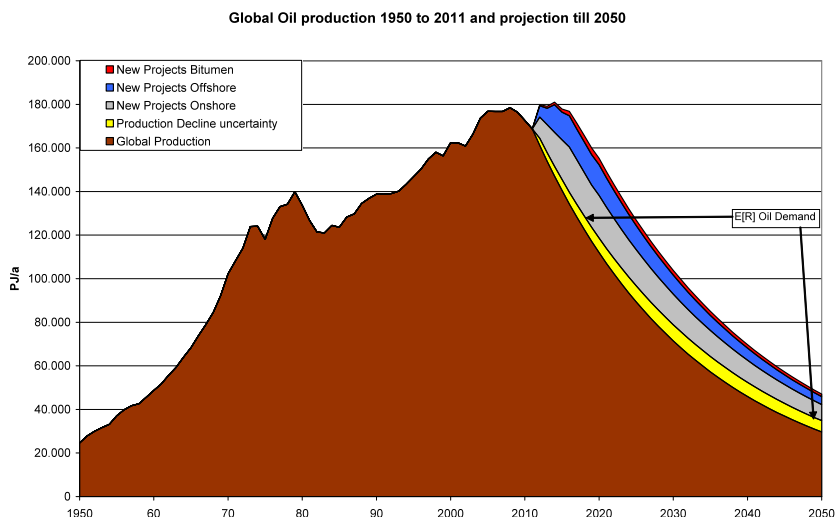
More than 80% of the current energy supply is based on fossil fuels. Oil dominates the entire transport sector; oil and gas fuel the heating sector and coal is the most-used fuel for power.

The renewable energy technology pathways to get off oil used in the 2012 scenario are based on currently available "off-the-shelf" technologies, market situations and market projections developed from renewable industry associations such as the Global Wind Energy Council, the European Photovoltaic Industry Association and the European Renewable Energy Council, the DLR and Greenpeace International.

This pathway is based on a detailed analysis of global conventional oil resources, the current infrastructure of those industries, the estimated production capacities of existing oil wells in light of projected production decline rates, and the investment plans known by the end 2011. To get off oil, financial resources must flow from 2012 onwards to developing new and larger markets for renewable energy technologies and energy efficiency to avoid "locking-in" new fossil fuel infrastructure.

Oil – production decline assumptions

The figure below shows the remaining oil production capacities with an annual production decline between 2.5% and 5% and the additional production capacities assuming all new projects planned for 2012 to 2020 go ahead. Even with new projects, the amount of remaining conventional oil is very limited: a transition towards a low oil demand pattern is essential.



The Energy [R]evolution key principles

The expert consensus is that this fundamental shift in the way we consume and generate energy must begin immediately and be well underway within the next ten years in order to avert the worst impacts of climate change.¹ The scale of the challenge requires a complete transformation of the way we produce, consume and distribute energy, while maintaining economic growth. The five key principles behind this shift will be to:

- Implement renewable energy solutions, especially through decentralised energy systems;
- Respect the natural limits of the environment;
- Phase out dirty, unsustainable energy sources;
- Create greater equity in the use of resources;
- Decouple economic growth from the consumption of fossil fuels;
- Decentralise energy systems, producing energy close to the point of final use to avoid the current energy waste in distribution;
- Invest in smart interactive grids and super grids, essential to transporting offshore wind and concentrating solar power;
- Build renewable micro grid clusters to provide sustainable electricity to the almost two billion people around the world without access to electricity

Projections to reality

Projected global installed wind power capacity at the end of 2010
in the first Global Energy [R]evolution, published in January 2007.

>> 156 GW

Actual global installed renewable capacity at the end of 2010

>> 197 GW

Actual installed capacity at the end of 2011

>> 237 GW

The Energy [R]evolution – key results

Renewable energy is a major success story already. Renewable energy accounted for 13.5% the world's primary energy demand in 2009. The main source is biomass, used mainly for heating.

For electricity generation, renewables contribute about 19.3% and for heat supply, around 25%, much of this is from traditional sources such as firewood. About 81% of the primary energy supply today still comes from fossil fuels and 5.5% from nuclear energy.

The Energy [R]evolution scenario describes development pathways to a sustainable energy supply, to achieve the urgently needed CO₂ reductions, to phase-out nuclear, without unconventional oil resources. The results of the Energy [R]evolution scenario which will be achieved by:

- Curbing global energy demand: In the Energy [R]evolution scenario, energy demand increases by only 10% compared to current consumption to 2020, decreasing slightly afterwards to 2009 levels.
- Controlling global power demand: Under the Energy [R]evolution scenario, energy efficiency can cut the need for new generation by about 30%, compared to the expected increase.
- Reducing global heating demand: Under the Energy [R]evolution scenario, energy needed for heating can be cut significantly – 9.727 PJ/a by 2020. Demand reductions would be achieved by renovating existing residential buildings, and by introducing low-energy standards. People would enjoy the same comfort and energy services.
- Development of global industry energy demand: The Energy [R]evolution scenario would cut energy demand by 40% per \$ GDP. Decoupling economic growth from energy demand is key to reaching a sustainable energy supply in the long term.
- Electricity generation: Under the scenario, by 2020 renewable energy could supply 37% of the world's electricity with installed capacity at 7,392 GW, up from 237 GW in 2011. In the long term, 94% of the world's electricity would come from renewable energy sources, and nuclear energy could be phased out and the number of fossil fuel-fired power plants, especially coal plants, could be reduced.

¹ IPCC – Special Report Renewables, Chapter 1, May 2011

- **Future costs of electricity generation:** In the near term, the costs of electricity generation under the scenario will be marginally higher than the Reference scenario with the gap dropping if oil prices go up. In the long term, electricity from renewables will be significantly lower than electricity from other sources.
- **The future electricity bill:** The shift to renewables and an increase in energy efficiency under the scenario would stabilize energy costs and, in the long term, would cut electricity costs by 40%.
- **Fuel costs savings:** Under the scenario, relying on renewable energy would produce \$1,320 billion US in fuel savings a year worldwide (average annual fuel costs savings 2009-2050).
- **Future employment in the energy sector:** Job numbers for all scenarios change to 2030, with the Energy [R]evolution scenario producing higher numbers of jobs in the global energy sector, instead of the job decline of the Reference scenario. By 2030, 65% of energy jobs would be in renewables.

Global Jobs	Reference				[R]evolution		
	2010	2015	2020	2030	2015	2020	2030
Construction and installation	2.953.328	1.850.615	1.626.291	1.166.469	3.300.909	2.856.073	2.439.752
Manufacturing	1.560.951	871.636	759.352	540.696	2.240.590	1.950.874	1.553.869
Operations and maintenance	1.712.682	1.833.812	1.950.555	1.905.192	1.933.976	2.317.085	2.604.473
Fuel supply (domestic)	14.717.024	12.728.578	11.857.114	10.737.862	12.884.695	11.667.272	8.772.417
Coal and gas export	1.128.709	1.307.764	1.452.076	1.216.189	1.345.309	1.248.587	588.671
Solar and geothermal heat	412.287	131.228	104.707	88.439	1.639.970	2.597.581	2.310.927
Total jobs	22.484.982	18.723.633	17.750.095	15.654.846	23.345.449	22.637.472	18.270.109
million	22,5	18,7	17,8	15,7	23,30	22,60	18,3
Global							
Coal		6.704.641	5.820.158	4.587.524	5.513.096	4.074.430	2.122.898
Gas, oil & diesel		5.161.527	5.296.165	5.439.888	5.357.939	5.280.799	3.891.214
Nuclear		501.167	416.768	301.036	266.456	304.022	379.735
Renewable		6.356.297	6.217.003	5.326.398	12.207.958	12.978.221	11.876.262
Total jobs		18.723.633	17.750.095	15.654.846	23.345.449	22.637.472	18.270.109

Table: Employment under the Reference and the Energy [R]evolution Scenario 2012

- **Global transport:** In the transport sector, it is assumed that energy consumption will continue to increase under the Energy [R]evolution scenario up to 2020 due to fast growing demand for services. After that, it will decline to the level of the current demand by 2050. Compared to the Reference scenario, transport energy demand is reduced overall by 60% or 90,000 PJ/a by 2050. Energy demand for transport under the Energy [R]evolution scenario will therefore increase between 2009 and 2050 by only 26% to 60,529 PJ/a.

Milestones for the transport sector

Significant energy savings from future cars are required. Applying new lightweight materials, in combination with new technologies, can bring fuel consumption levels down to 1 litre per 100 km from the current 7 litres per 100 km in Europe and 11 litres per 100 km in North America. The scenario calls for new cars in Europe to have average emissions of 80 grams of CO₂ per km by 2020 and 50g by 2030. In 2010, the European standard was 140 grams. In 2020, electricity will provide 3.5% of the transport sector's total energy demand in Europe (2.5% global) and 12% by 2030.

- **Primary energy consumption:** Under the Energy [R]evolution scenario, overall primary energy demand will be reduced by 40% in 2050 compared to the Reference scenario, with almost the entire global electricity supply, including most of the energy for buildings and industry, coming from renewable energy sources. The transport sector, in particular aviation and shipping, would be the last sector to become fossil fuel free.
- **Development of CO₂ emissions:** Worldwide CO₂ emissions in the Reference case will increase by 62% while under the Energy [R]evolution scenario they will decrease by almost 90% (27,925 million tons in 2009 to 3,076 million tons) in 2050. Even with a phase out of nuclear energy and increasing demand, CO₂ emissions will decrease in the electricity sector. By 2050 the Global Energy related CO₂ emissions would be 85% lower than 1990 levels.

Policy changes

To make the Energy [R]evolution real and to avoid dangerous climate change, Greenpeace, GWEC and EREC demand that the following policies and actions are implemented in the energy sector:

1. Phase out all subsidies for fossil fuels and nuclear energy.
2. Internalise the external (social and environmental) costs of energy production through 'cap and trade' emissions trading.
3. Mandate strict efficiency standards for all energy consuming appliances, buildings and vehicles.
4. Establish legally binding targets for renewable energy and combined heat and power generation.
5. Reform the electricity markets by guaranteeing priority access to the grid for renewable power generators.
6. Provide defined and stable returns for investors, for example by feed-in tariff programmes.
7. Implement better labelling and disclosure mechanisms to provide more environmental product information.
8. Increase research and development budgets for renewable energy and energy efficiency.

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