



The Energy [R]evolution scenario

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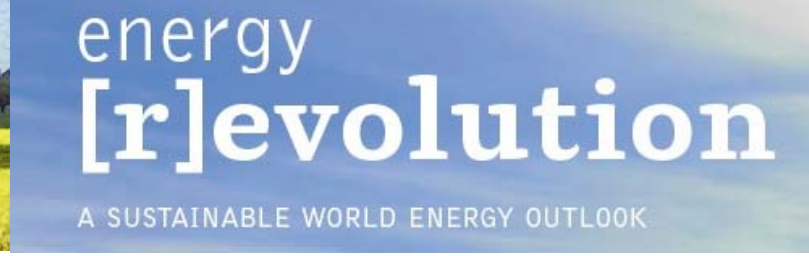
EREC – European Renewable Energy Council

Umbrella organisation representing all RES sectors:

- ✓ **AEBIOM** European Biomass Association
- ✓ **EGEC** European Geothermal Energy Council
- ✓ **EPIA** European Photovoltaic Industry Association
- ✓ **ESHA** European Small Hydropower Association
- ✓ **ESTIF** European Solar Thermal Industry Federation
- ✓ **EUBIA** European Biomass Industry Association
- ✓ **EWEA** European Wind Energy Association
- ✓ **EUREC Agency** European Renewable Energy Research Centres Agency
- ✓ **EU-OEA** European Ocean Energy Association
- ✓ **EREF** European Renewable Energy Federation
- ✓ **ESTELA** European Solar Thermal Electricity Association

Representation of European RES industry & research community

Annual turnover: 70 billion €, 550.000 jobs



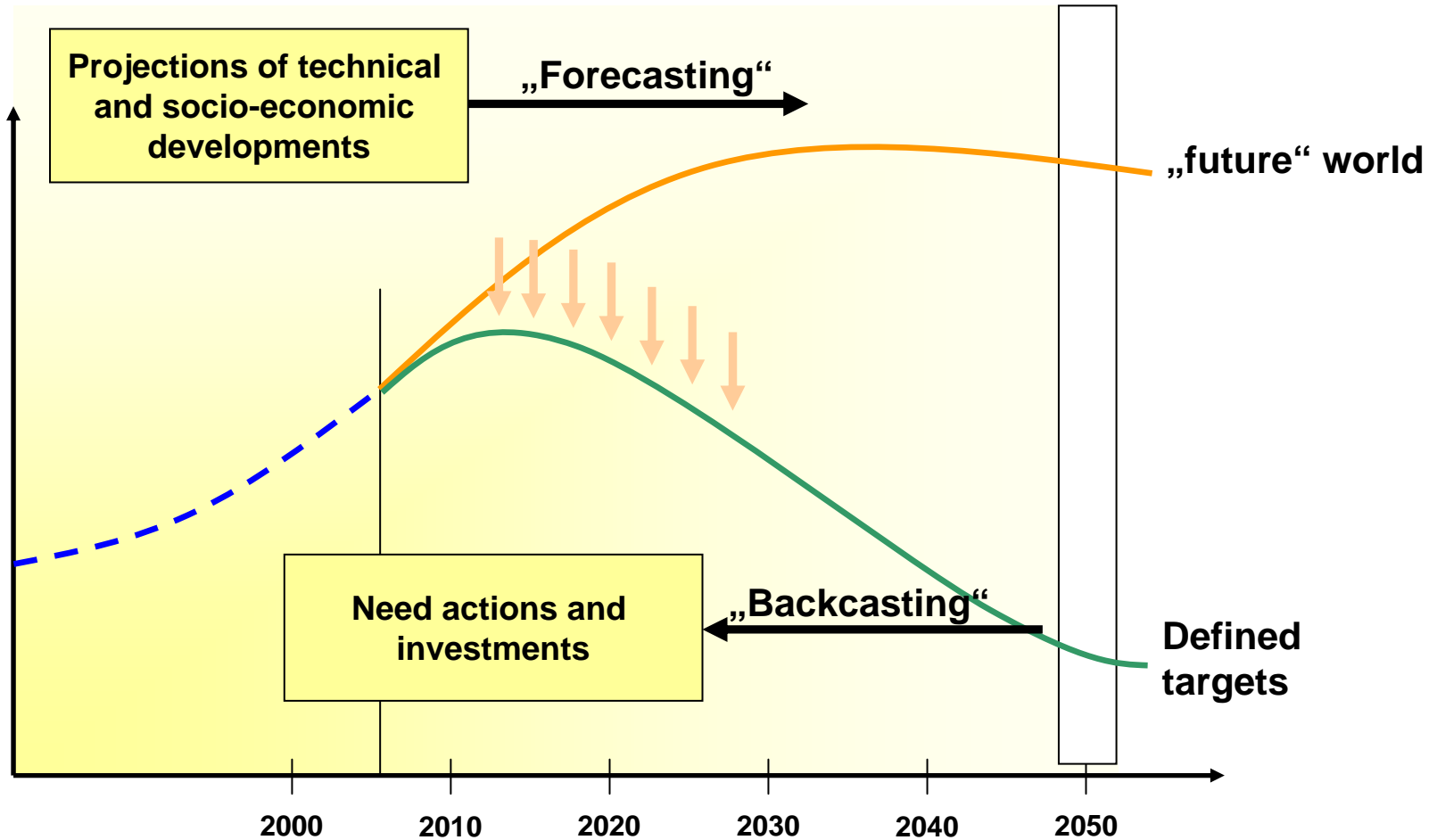
Why Scenarios?

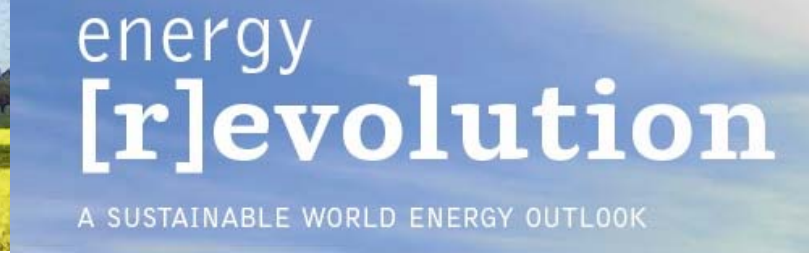
- images of alternative futures
- neither predictions nor forecasts
- image of how the future could unfold
- useful tools for investigating alternative future developments and their implications

Scenarios can create a vision for the future and guide decision makers.



Development of different scenarios





Climate & Energy Policy targets:

- Stabilize global CO_2 -concentration under 400 ppm
- Global CO_2 emission peak by 2015
- Per capita emissions by 2050: $\sim 1 \text{ tCO}_2/\text{a}$
- Rapid fossil fuel phase-out
- Only proven technology will be used
- Equity and fairness, sustainable economic growth



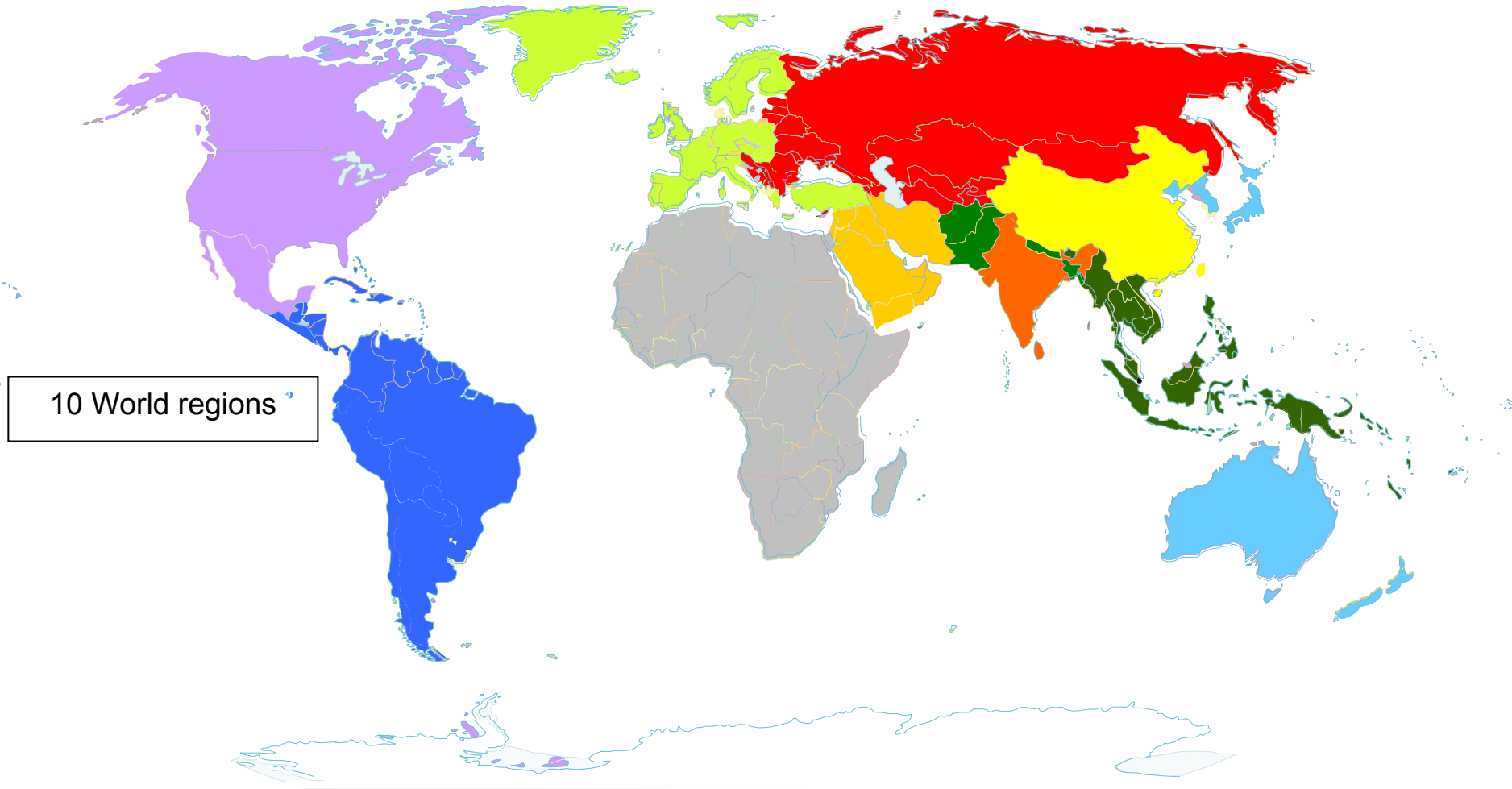
Approach

- Development of a 10-region model (based on IEA regions)
- Economic development and population development according to IEA World Energy Outlook 2006 (extrapolated to 2050)
- Reference Scenario: based on IEA World Energy Outlook 2006 (extrapolated to 2050)
- Alternative Scenarios:
 - demand scenarios: Ecofys
 - supply scenarios: DLR
- Review process:
 - regional counterparts (academia, NGO)
 - EREC / Greenpeace



energy [r]evolution

A SUSTAINABLE WORLD ENERGY OUTLOOK





The logic of the “energy [r]evolution scenario”

From principles to practice - Use the current “time window” for

Step 1: Energy Efficiency

Step 2: Structural Changes

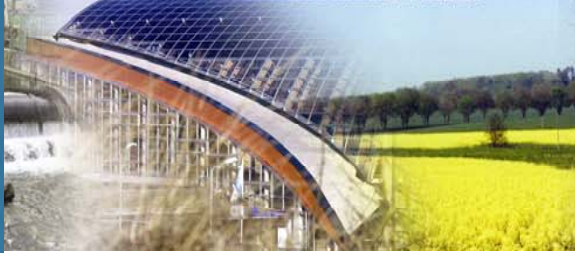
- . Decentralised energy and large scale renewables
- . Cogeneration

Step 3: Energy Efficient Transport

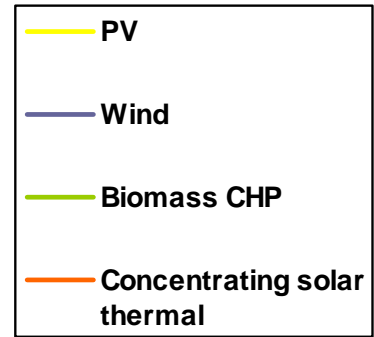
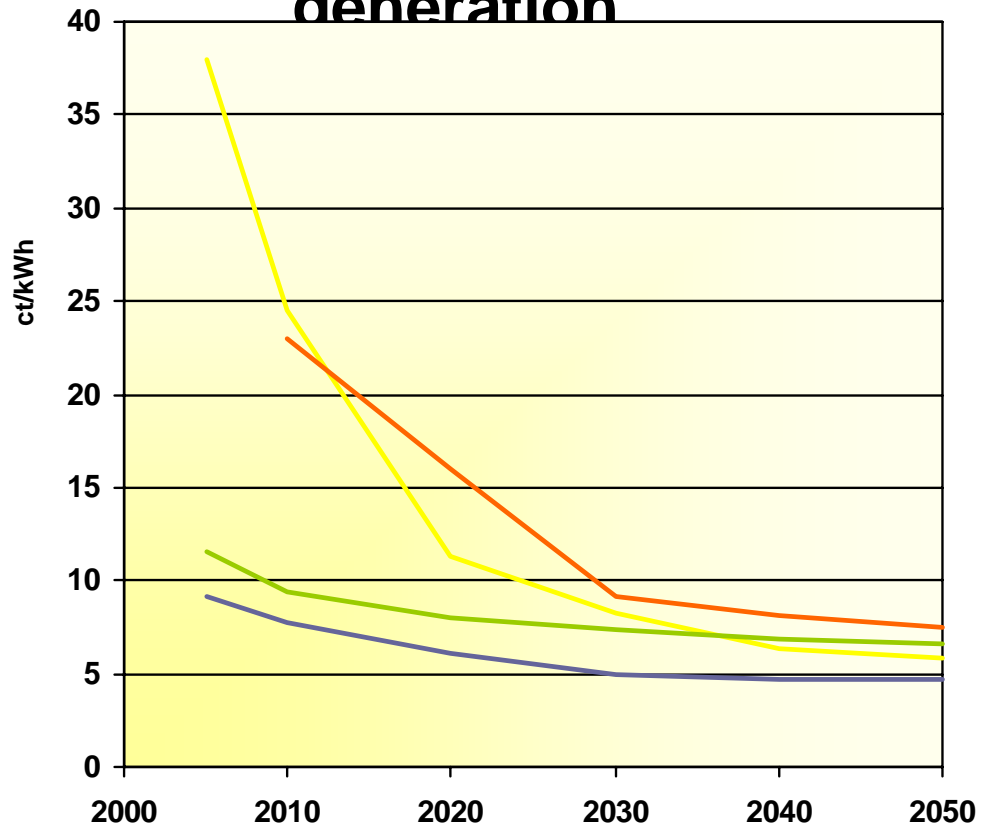
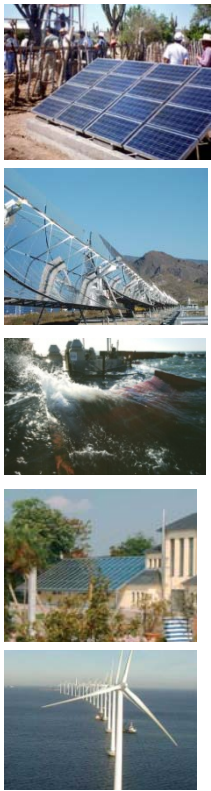
- . Efficient Public Transport Systems
- . Efficient Cars, Trucks etc.
- . Sustainable biofuels

Scenario principles in a nutshell

- . Smart consumption, generation and distribution
- . Energy production moves closer to the consumer
- . Maximum use of locally available, environmentally friendly fuels



Cost development of renewable electricity generation





Fossil Fuels costs (Imports)

	2005	2010	2020	2030	2040	2050
Oil (\$ ₂₀₀₅ /barrel)	52,5	100	110	120	130	140
Natural gas (\$ ₂₀₀₅ /GJ)	5,8	10	13,3	17,2	20,6	23
Coal (\$ ₂₀₀₅ /t)	76,8	143	194	251	311	359

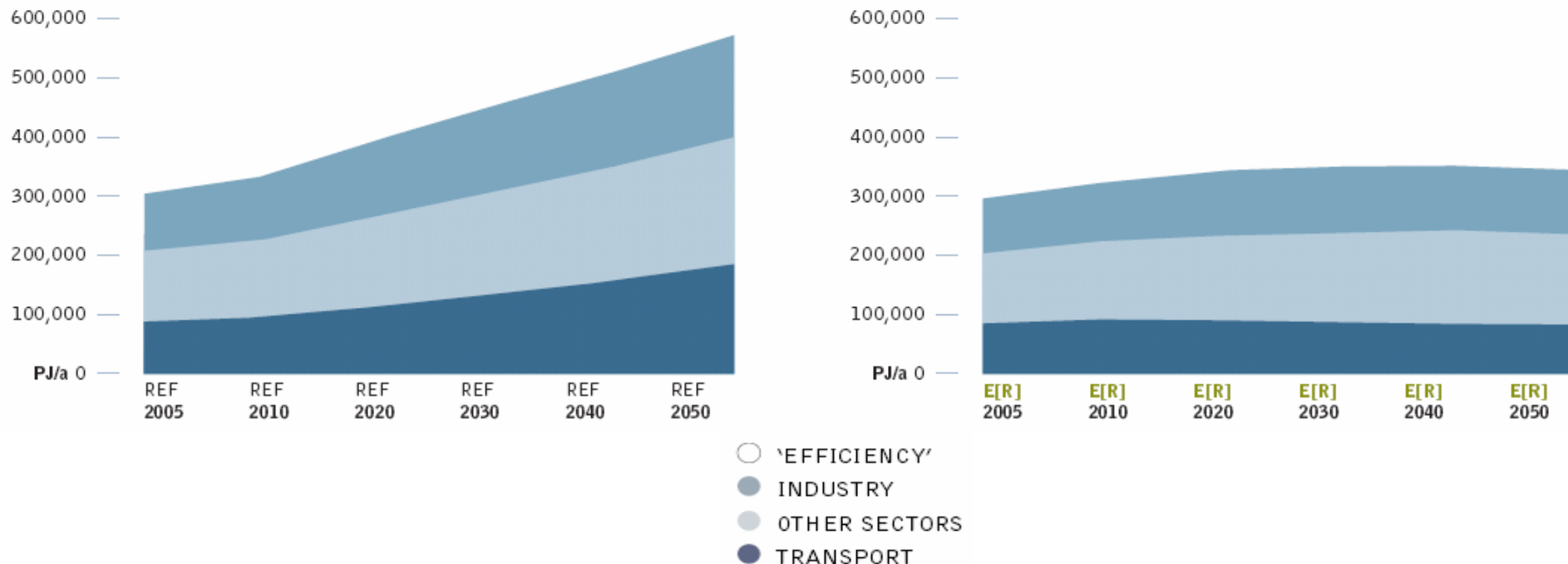
the energy [r]evolution: demand development

The Energy [R]evolution scenario saves 91 Exa-Joule by 2020 – compared to the Reference Scenario – this is equal to Europe's current total energy demand.

Most important measures:

- Building insulation
- Strict efficiency standards for all electrical applications,
- Strict efficiency standards for all vehicles.

figure 6.4: global: projection of final energy demand by sector for the two scenarios



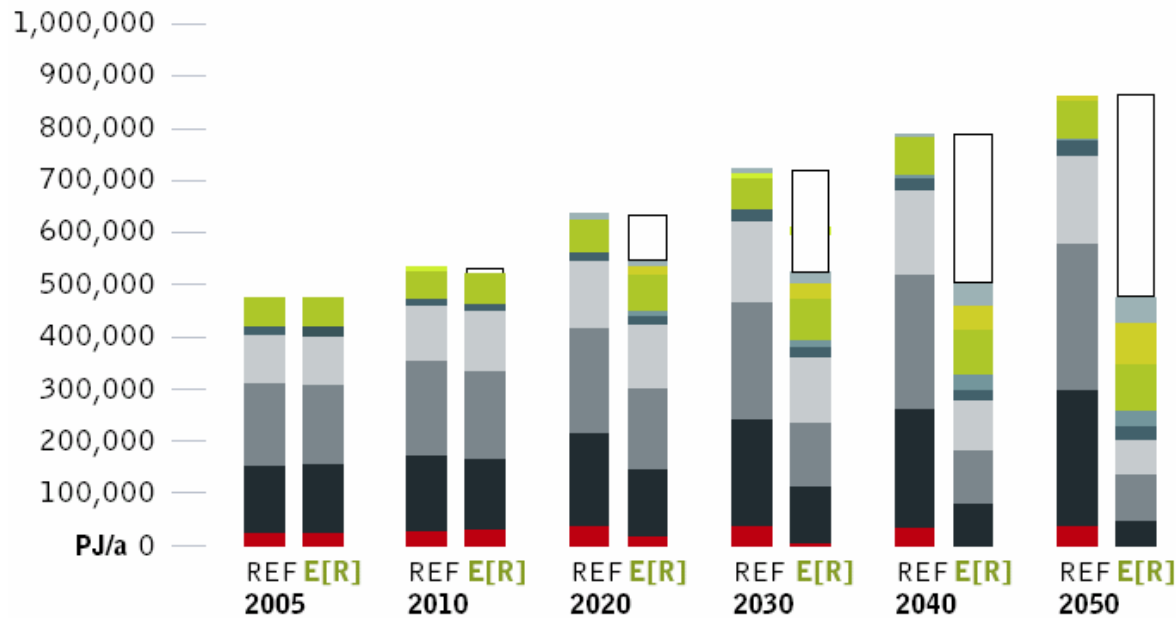
the energy [r]evolution: shift towards renewables

Renewable energy shares:

	Primary energy	Final energy
today:	12.9 %	16.4%
2020:	21.0 %	24.4%
2030:	30.9%	33.8%
2050:	56.1%	56.8%

figure 6.13: global: development of primary energy consumption under the two scenarios

(‘EFFICIENCY’ = REDUCTION COMPARED TO THE REFERENCE SCENARIO)



- 'EFFICIENCY'
- OCEAN ENERGY
- GEOTHERMAL
- SOLAR
- BIOMASS
- WIND
- HYDRO
- NATURAL GAS
- CRUDE OIL
- COAL
- NUCLEAR

figure 6.8: global: growth of renewable electricity generation under the energy [r]evolution scenario

BY INDIVIDUAL SOURCE

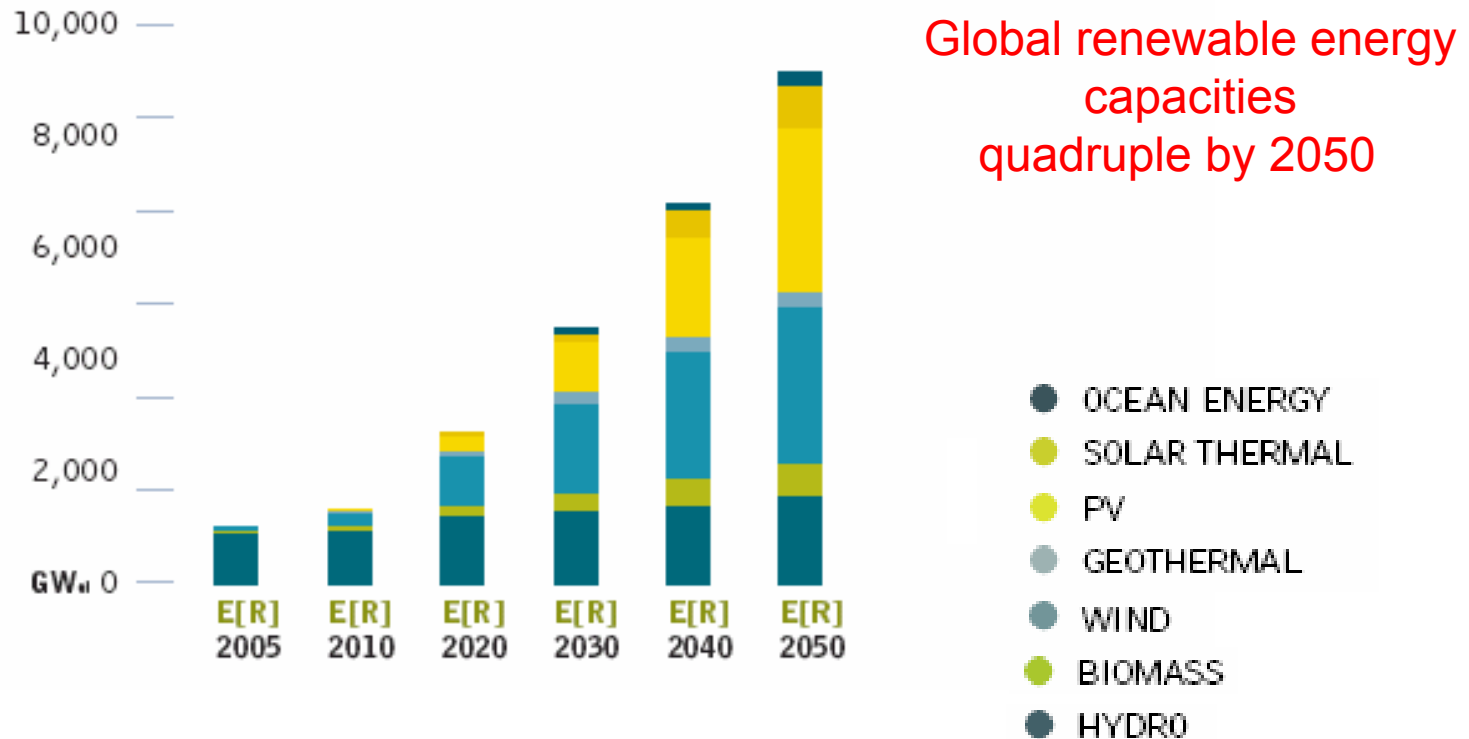
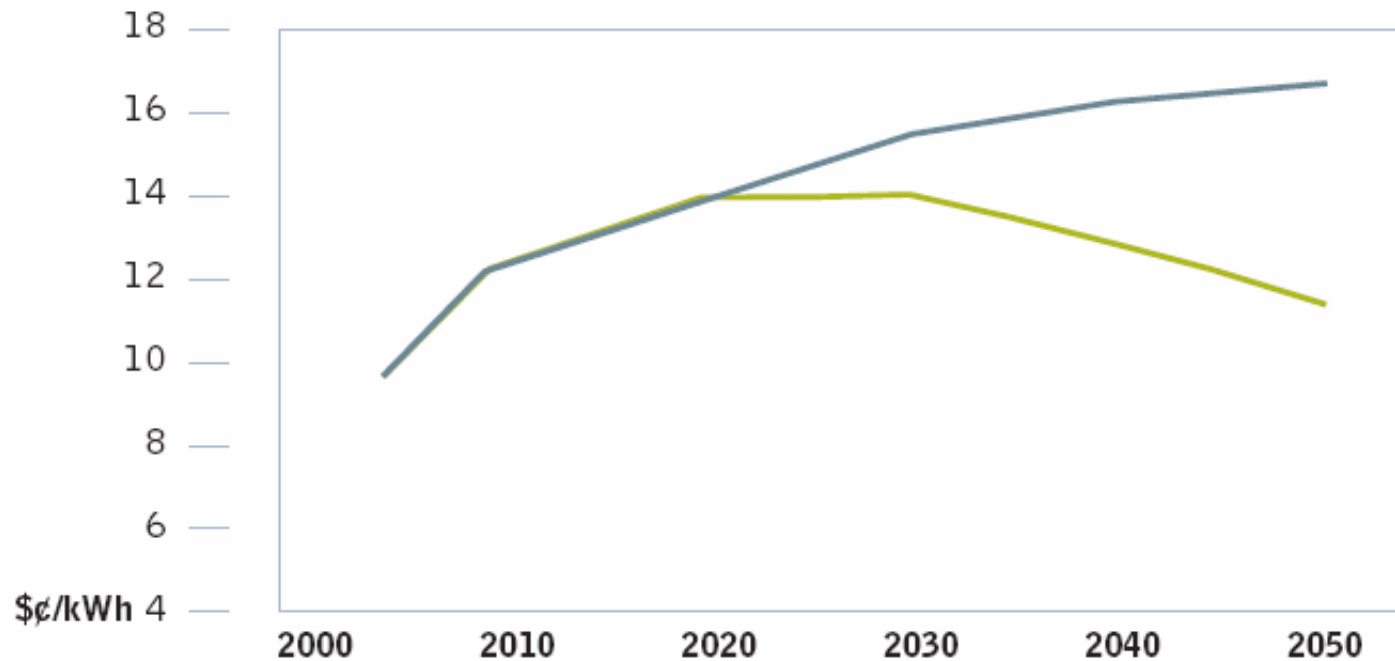


figure 6.9: global: development of specific electricity generation costs under the two scenarios

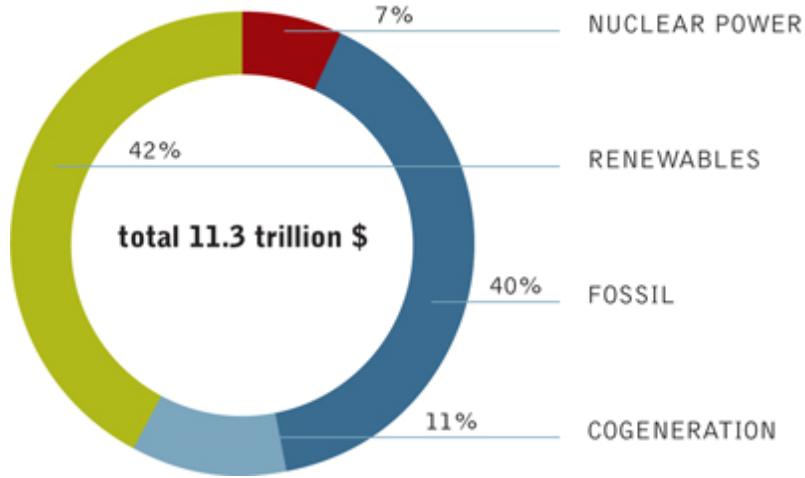
(CO₂ EMISSION COSTS IMPOSED FROM 2010,
WITH AN INCREASE FROM 15 \$/T_{CO₂} IN 2010 TO 50 \$/T_{CO₂} IN 2050)



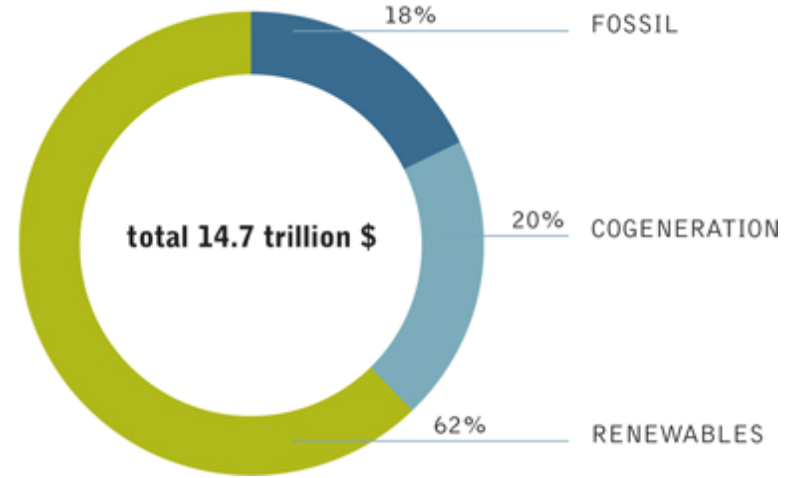
Future Investment

figure 11: investment shares - reference versus energy [r]evolution

reference scenario 2005 - 2030



energy [r]evolution scenario 2005 - 2030



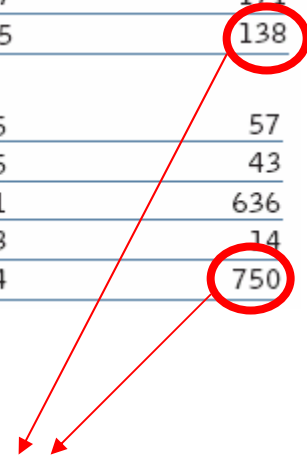
Saved Fuel Costs

table 7.3: fuel and investment costs in the reference and the energy [r]evolution scenario

INVESTMENT COST	DOLLAR	2005-2010	2011-2020	2021-2030	2005-2030	AVERAGE 2005-2030 PER YEAR
DIFFERENCE ECRJ VERSUS REF						
Total Fossil & Nuclear	billion \$ 2005	-101	-967	-1,443	-2,511	-100
Total Cogeneration	billion \$ 2005	89	678	902	1,669	67
Total Renewables	billion \$ 2005	136	1,637	2,514	4,287	171
Total	billion \$ 2005	124	1,348	1,973	3,445	138
SAVINGS REF VERSUS ECRJ						
Fuel Oil	billion \$/a	27	438	949	1,415	57
Gas	billion \$/a	-59	-147	1,291	1,085	43
Coal	billion \$/a	185	3,476	12,241	15,901	636
Lignite	billion \$/a	7	100	236	343	14
Total Fossil Fuel Savings	billion \$/a	161	3,866	14,716	18,744	750

Today – 2030: Saved fuel costs are 5 x higher than additional investment costs

Factor 5



the energy [r]evolution: CO₂ emissions

Energy related CO₂ emissions – reductions based on 1990 levels:

2005: +14% 2010: +26% 2020: +19% 2030: -2% 2040: -27% 2050: -51%

figure 6.14: global: development of CO₂ emissions by sector under the energy [r]evolution scenario

(‘EFFICIENCY’ = REDUCTION COMPARED TO THE REFERENCE SCENARIO)

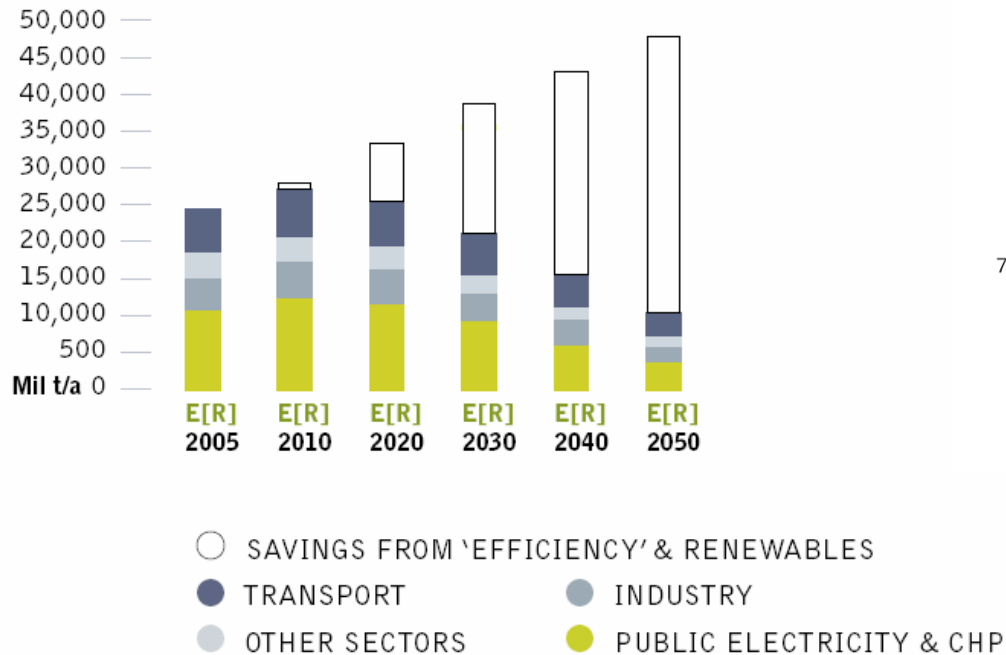
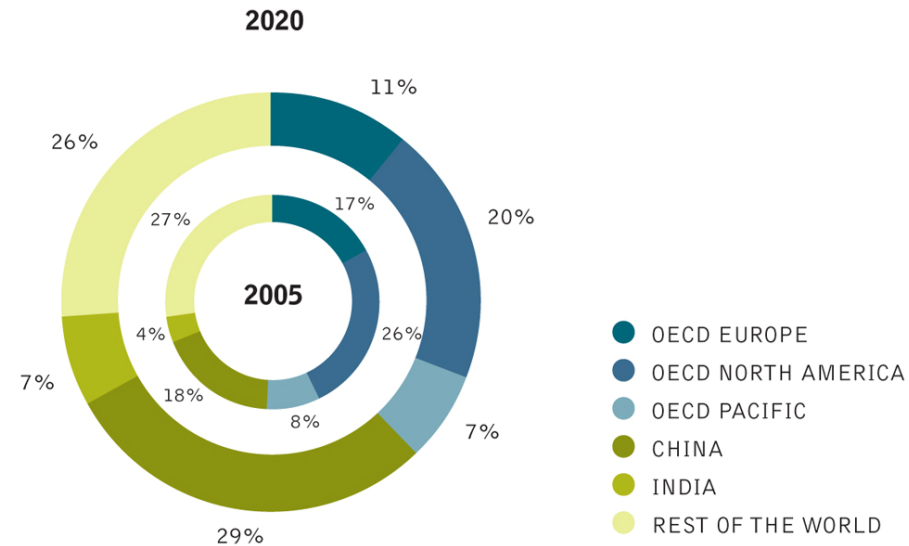
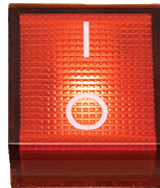


figure 2: CO₂ emissions by region in 2005 and 2020



We must take action now!

Governments around the world must show that they are serious about climate change by acting now to bring about an Energy [R]evolution.



**Europe should lead
by example.**

We need our global leaders to:

1. Phase out 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. Increase research and development budgets for renewable energy and energy efficiency.



Further information:

www.erec.org

www.energyblueprint.info

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