

**ENERGY REVOLUTION:
A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE**



**Energy Revolution:
A sustainable pathway to a clean energy future for
Latin America**

Rio / Brazil

17th November 2006

**Greenpeace International
Renewable Energy Director
Sven Teske**

**Greenpeace Brazil
Campaign Director
Marcelo Furtado**



GREENPEACE

ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



Development of a normative scenario describing a development pathway of the Latin American energy supply - supporting sustainable development.

“+2°C Scenario” :

- describes energy supply options in compliance with key sustainability targets & is a combination of the existing globale technology reports
 - Global Wind Energy Outlook,
 - SolarGeneration III
 - Concentrated Solar Power 2020

. Reference Scenario:

reflects a continuation of current trends and policies into the future

Regions:

North America
Africa
South Asia
OECD Pacific

Latin America
Middle East
East Asia

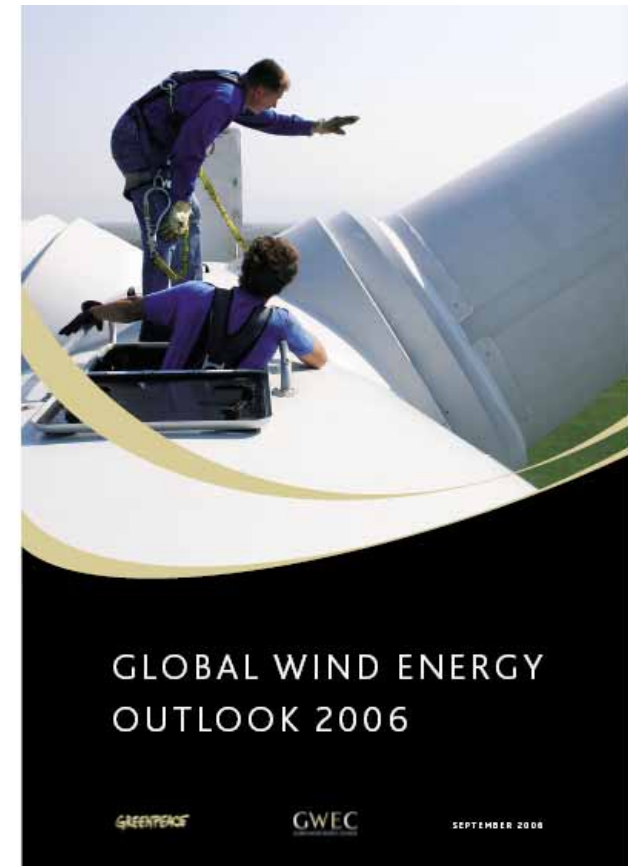
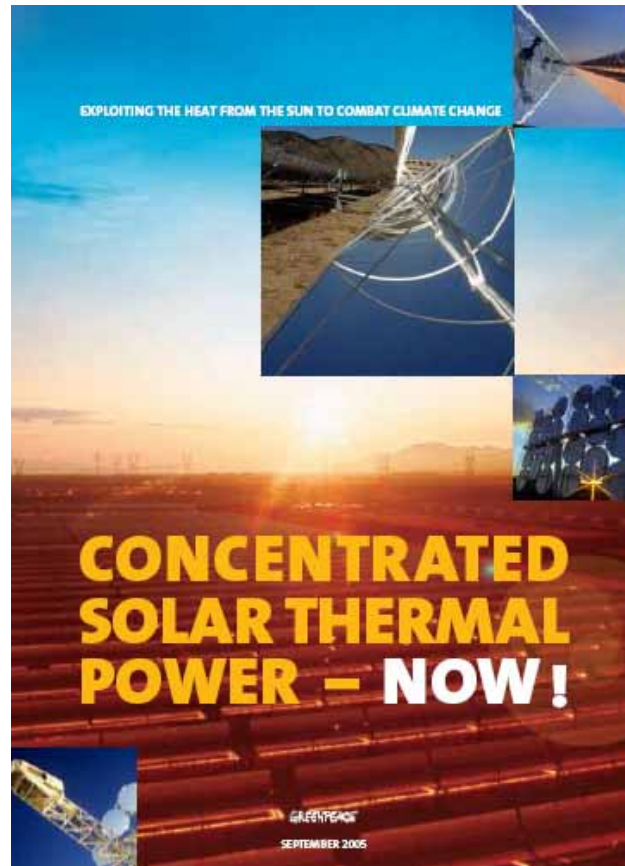
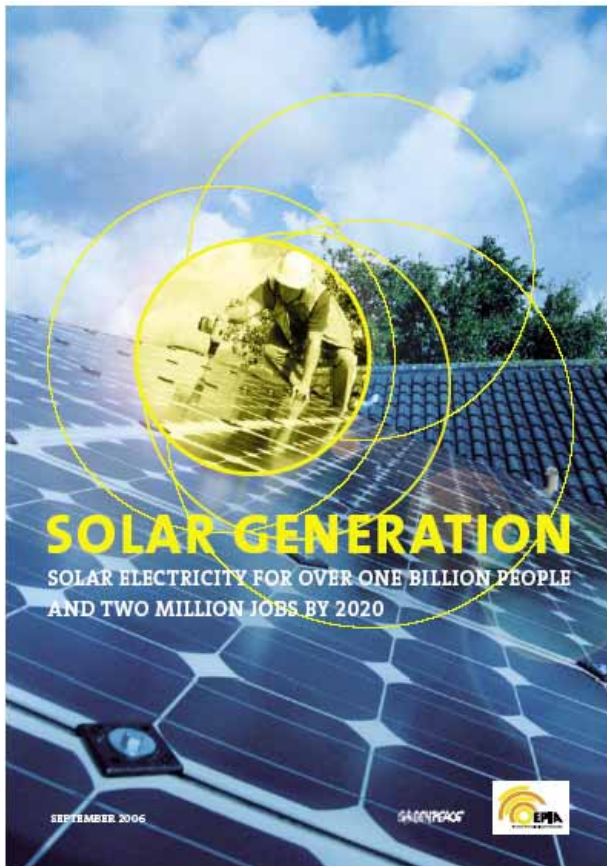
OECD Europe
Transition Economies
China



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



Greenpeace Renewable Energy Reports:



GREENPEACE

ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



The “+2°C Scenario”

An Energy Revolution is necessary and possible, and we can achieve it by adhering to five key principles.

1. **Implement Clean, Renewable Solutions & Decentralise Energy Systems**
2. **Respect Natural Limits**
3. **Phase out Dirty, Unsustainable Energy**
4. **Equity and fairness**
5. **Decouple Growth from Fossil Fuel Use**



GREENPEACE

ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



The Logic of “+2°C 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

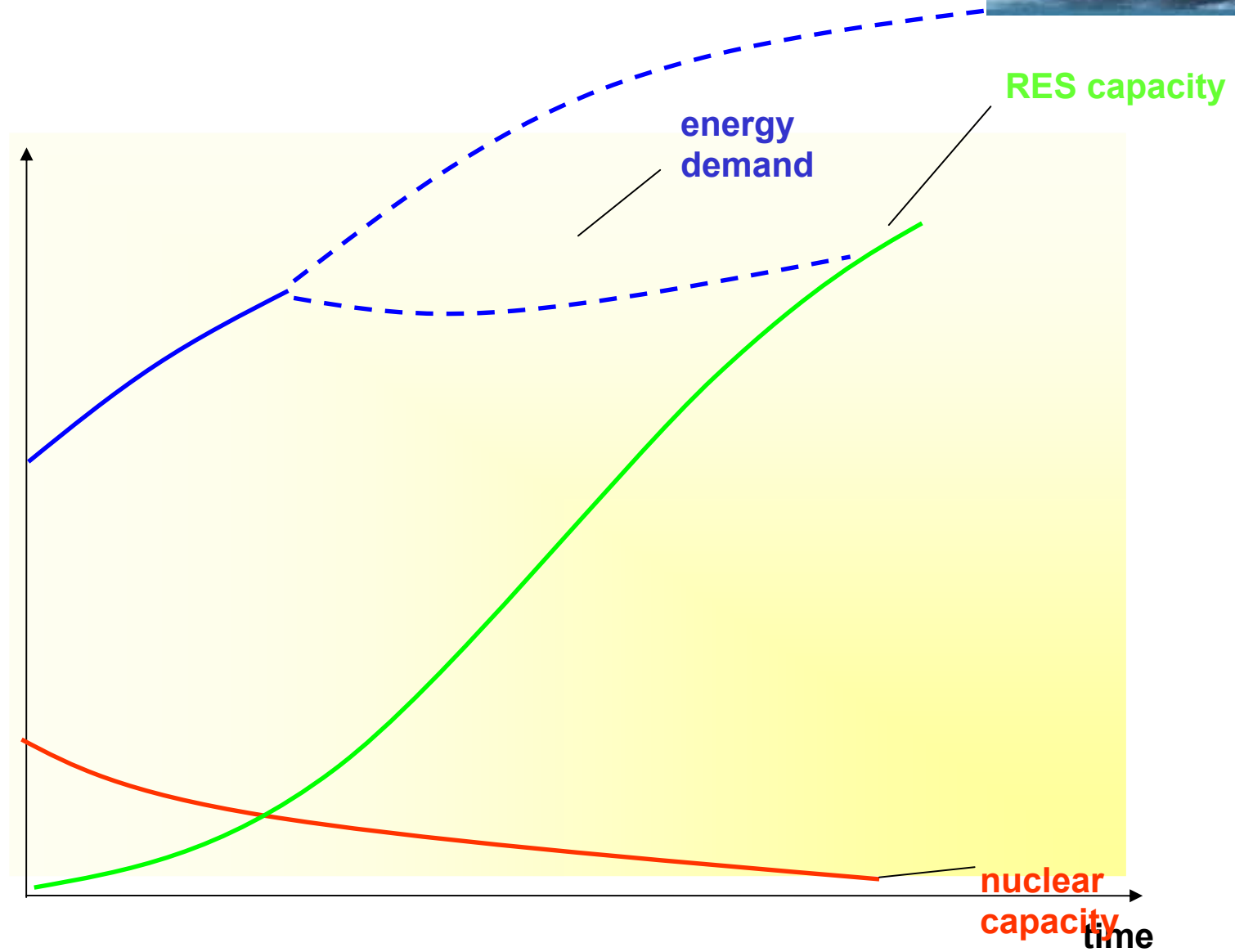
Scenario principles in a nutshell

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



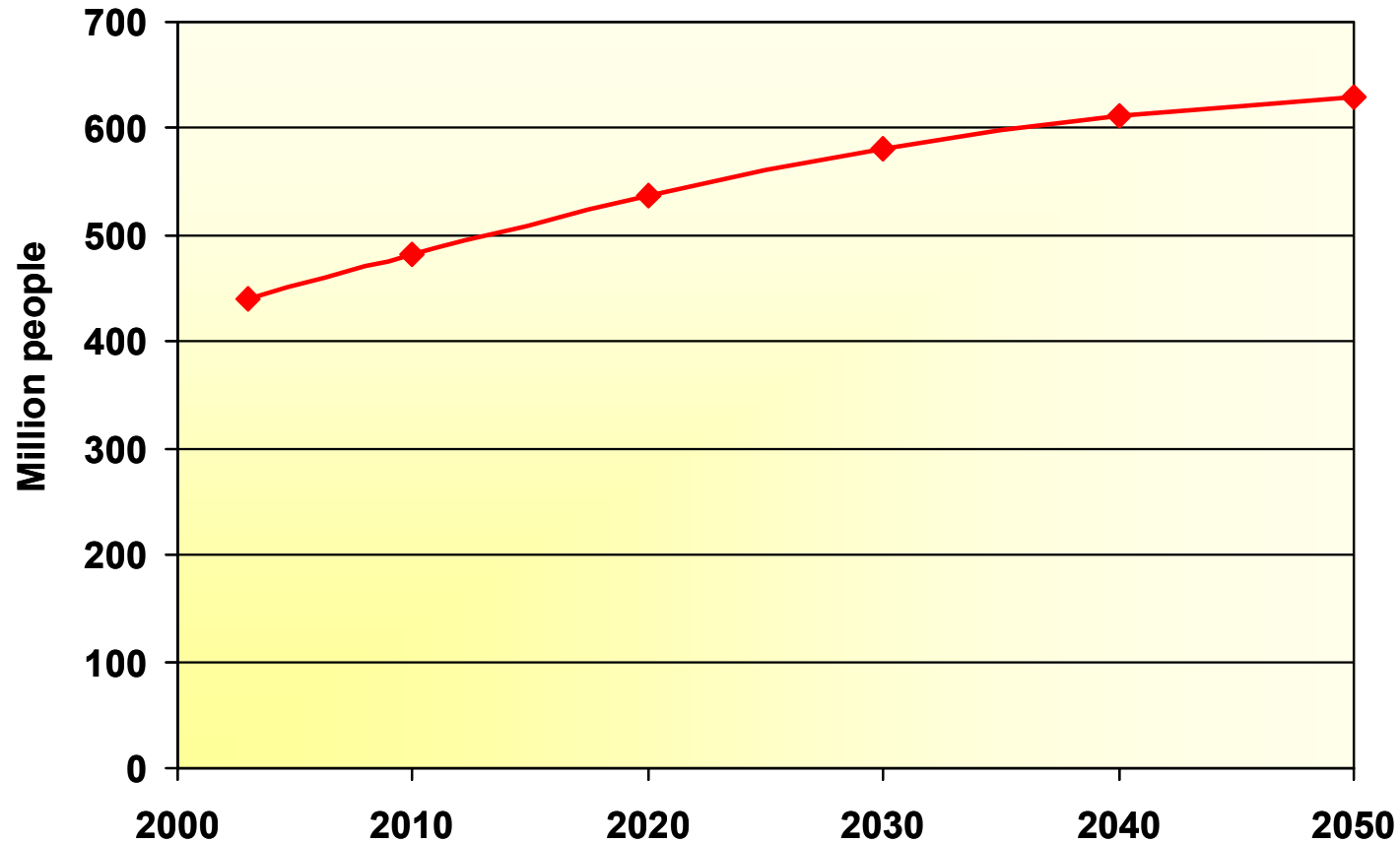
GREENPEACE

ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



GREENPEACE

ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



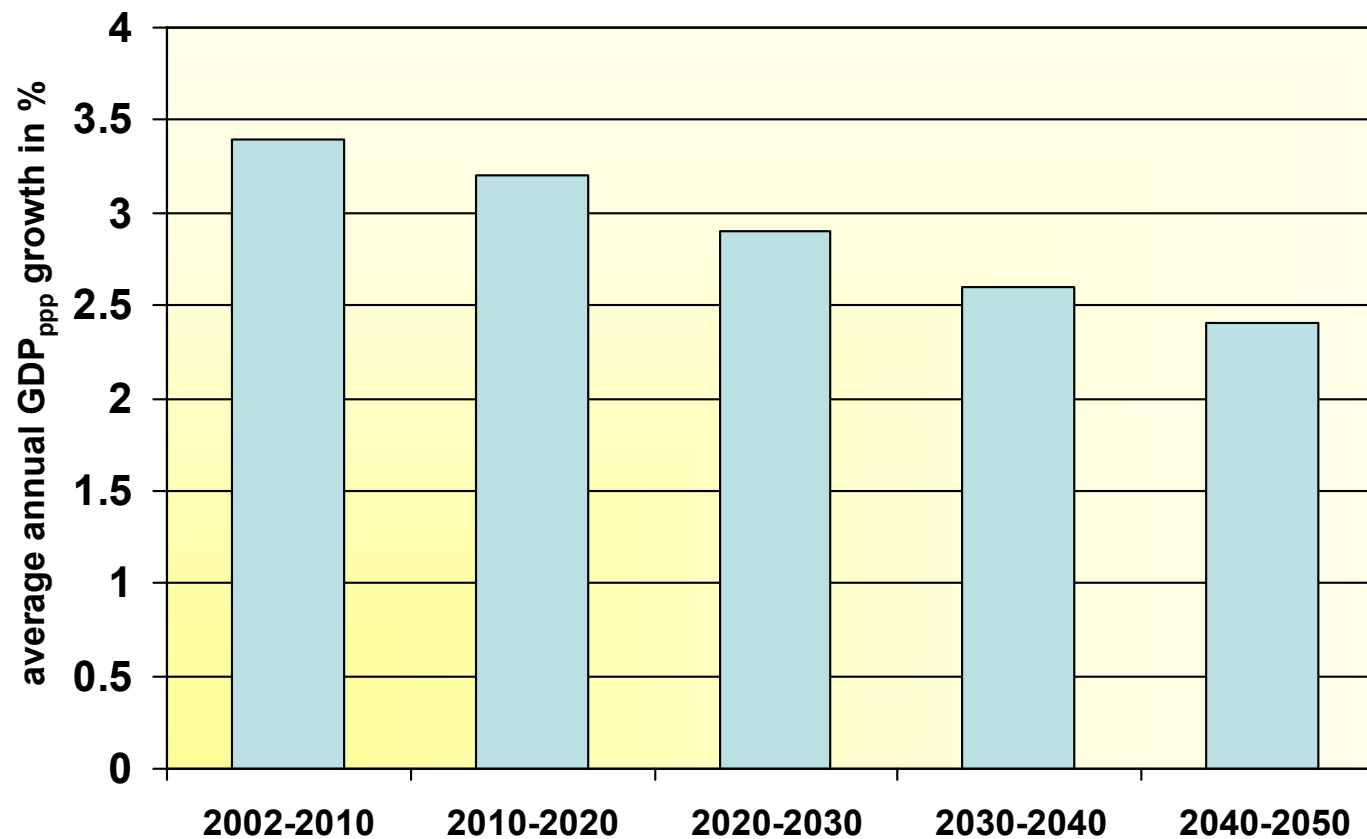
Projection of Latin American population development



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



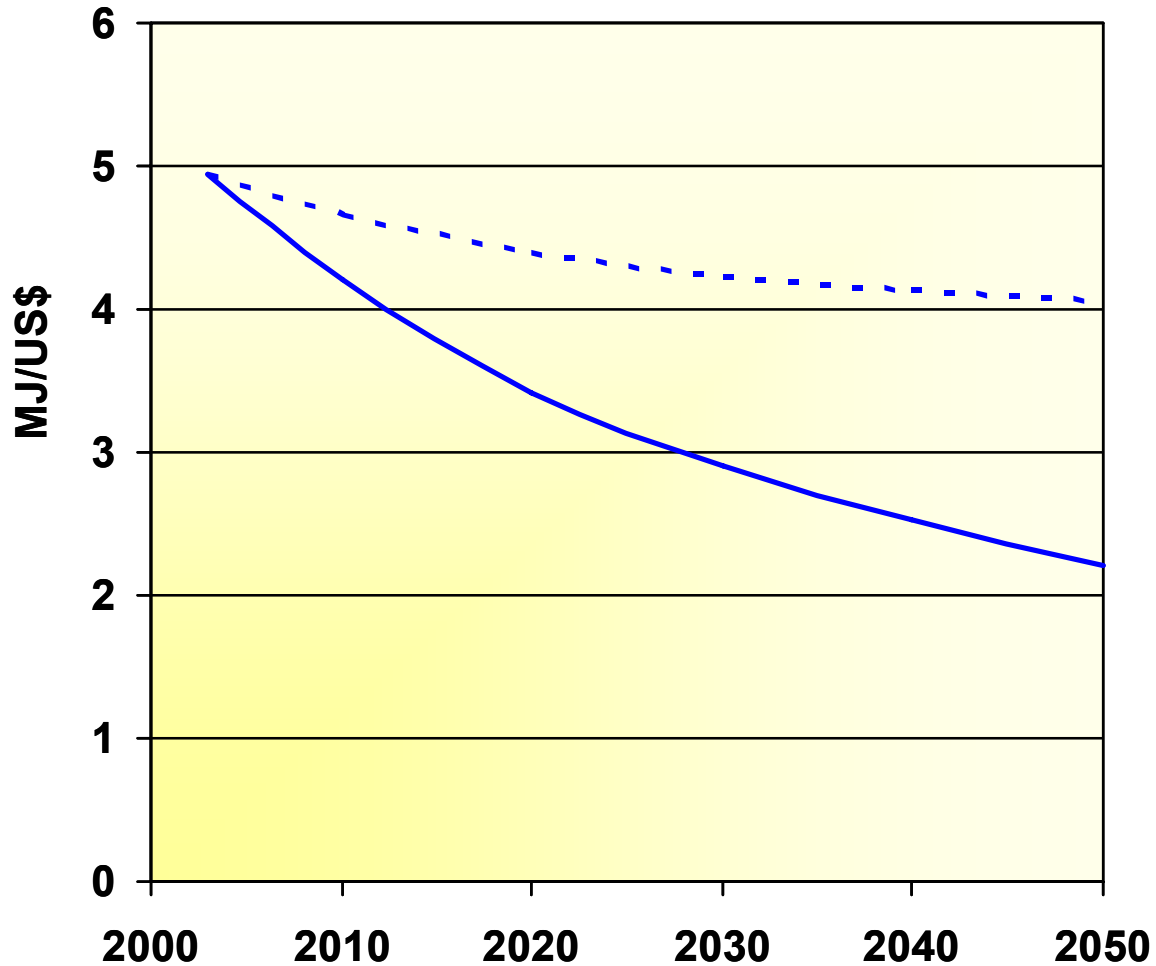
Projection of the Latin American GDP development



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



Projection of Latin American Energy Intensities by Demand Sector



• Energy Intensity is projected to decrease in the Reference Scenario (Source: IEA)

• “+2°C” Scenario estimates a higher decrease of the energy intensity especially in the industry sector.

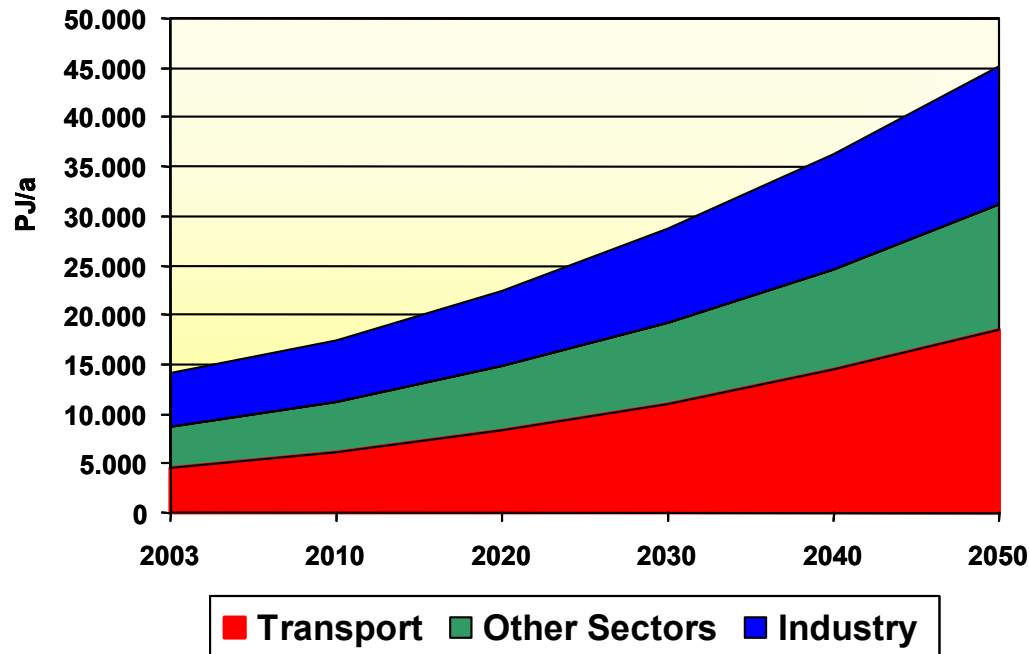


ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE

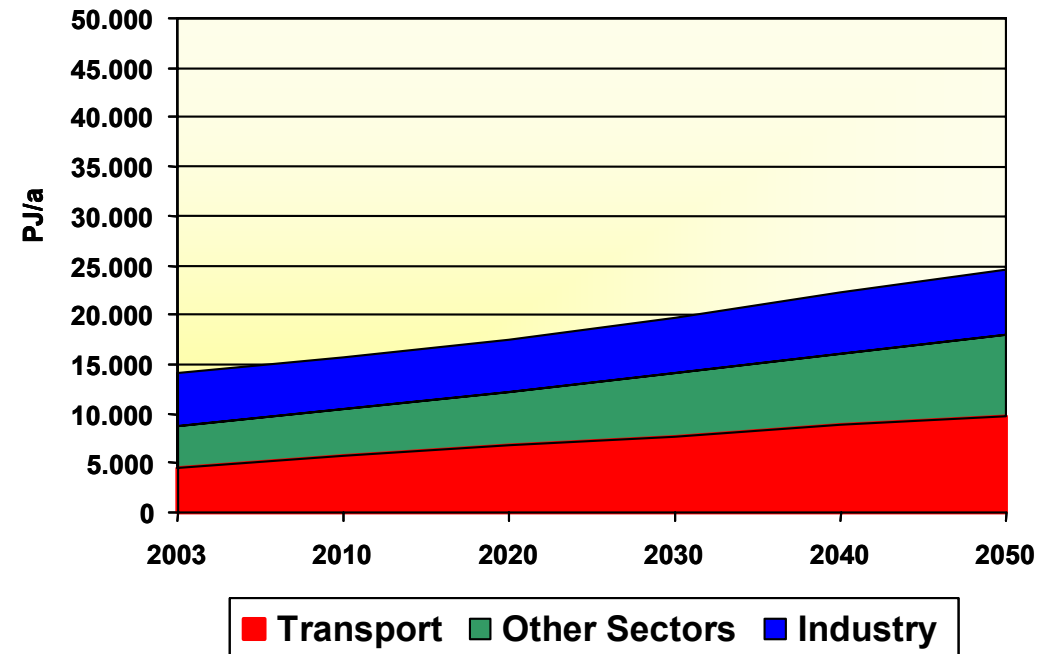


Development of Final Energy Demand for Electricity by Demand Sector

Reference Scenario



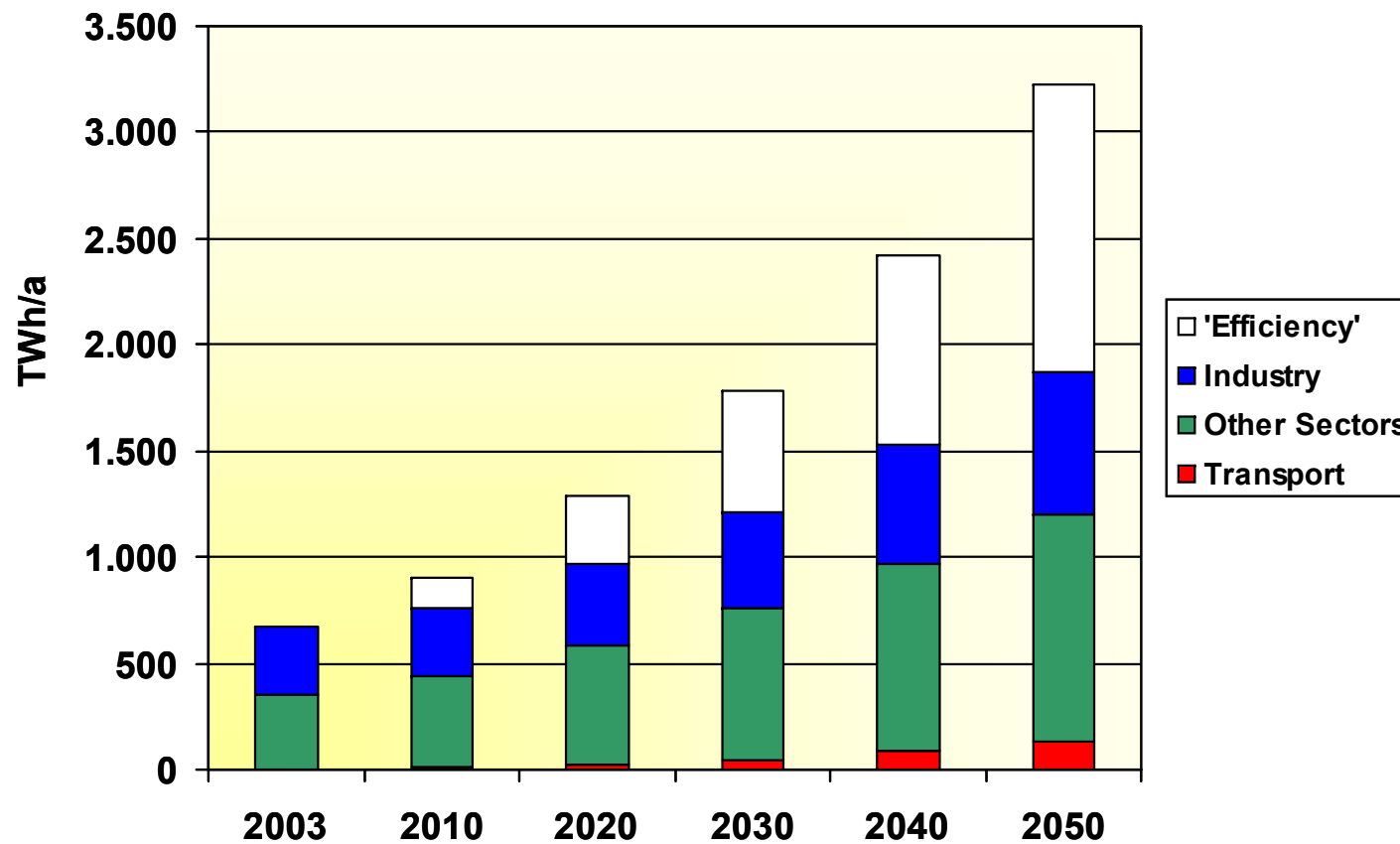
Energy Revolution Scenario



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



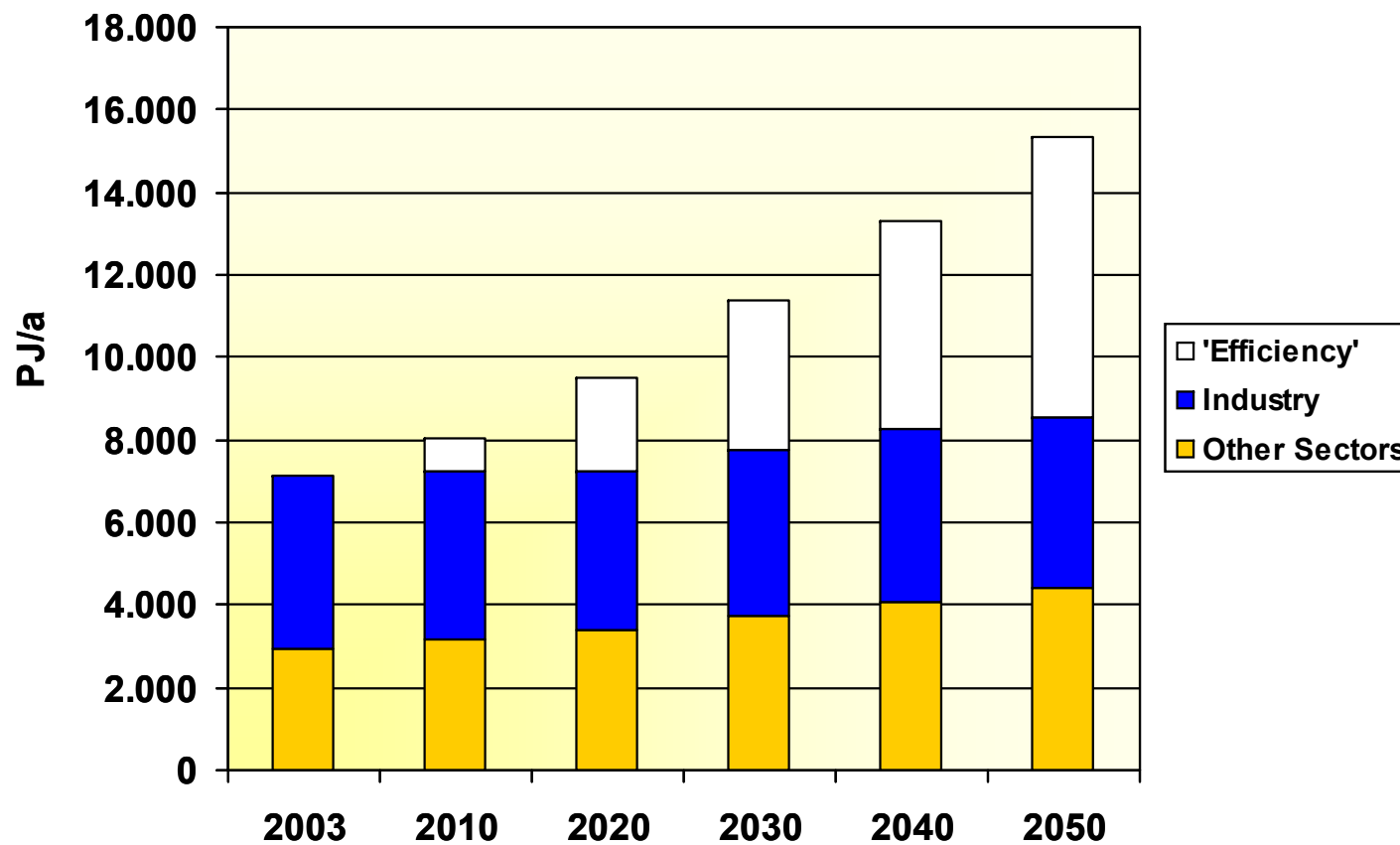
Development of final energy demand for electricity by demand sectors
(‘Efficiency’ = reduction compared to the Reference Scenario)



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



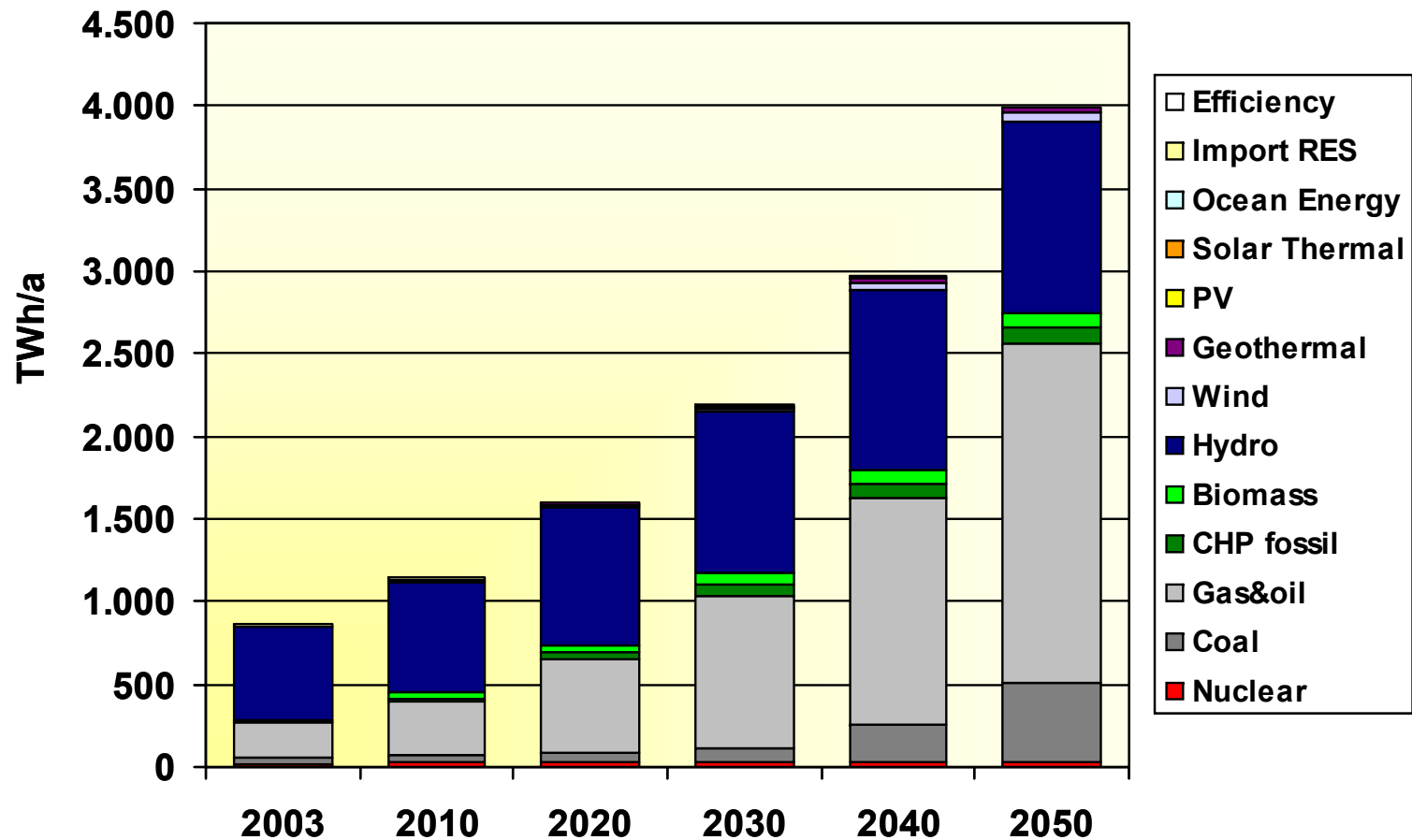
Development of final energy demand for heat supply
(‘Efficiency’ = reduction compared to the Reference Scenario)



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



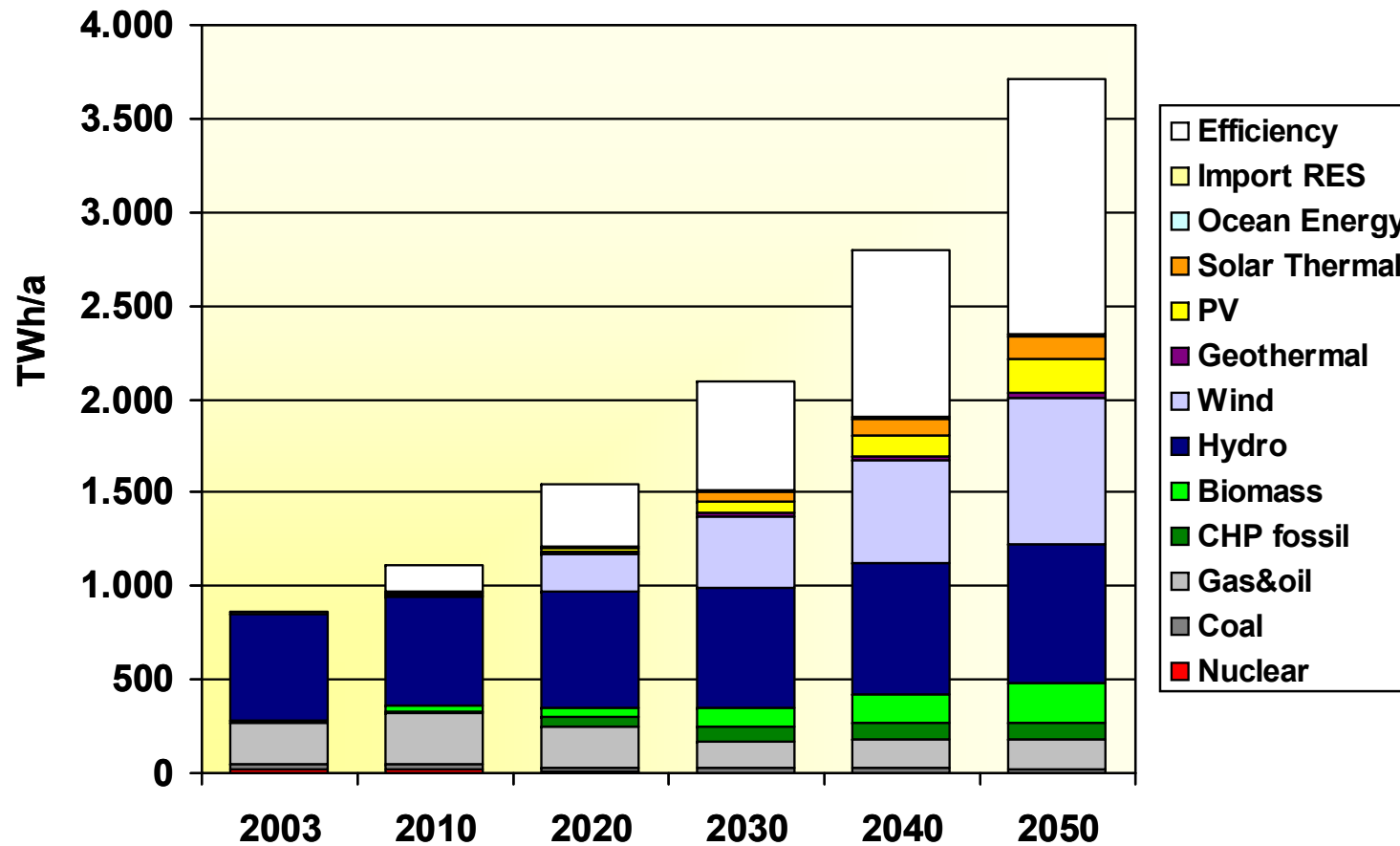
Development of the electricity supply structure under the Reference Scenario



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



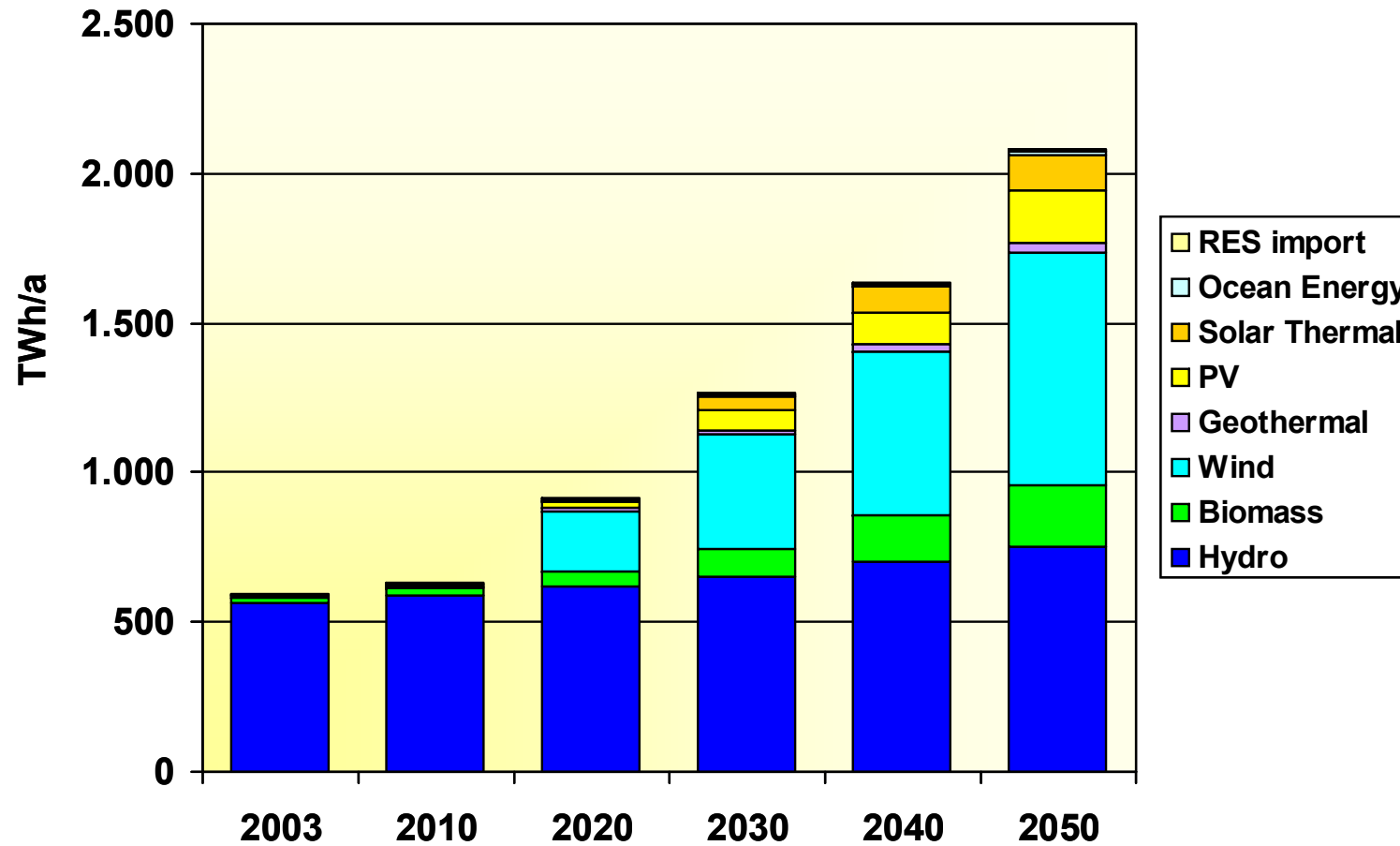
Development of the electricity supply structure under the “+2°C” Scenario
(‘Efficiency’ = reduction compared to the Reference Scenario)



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



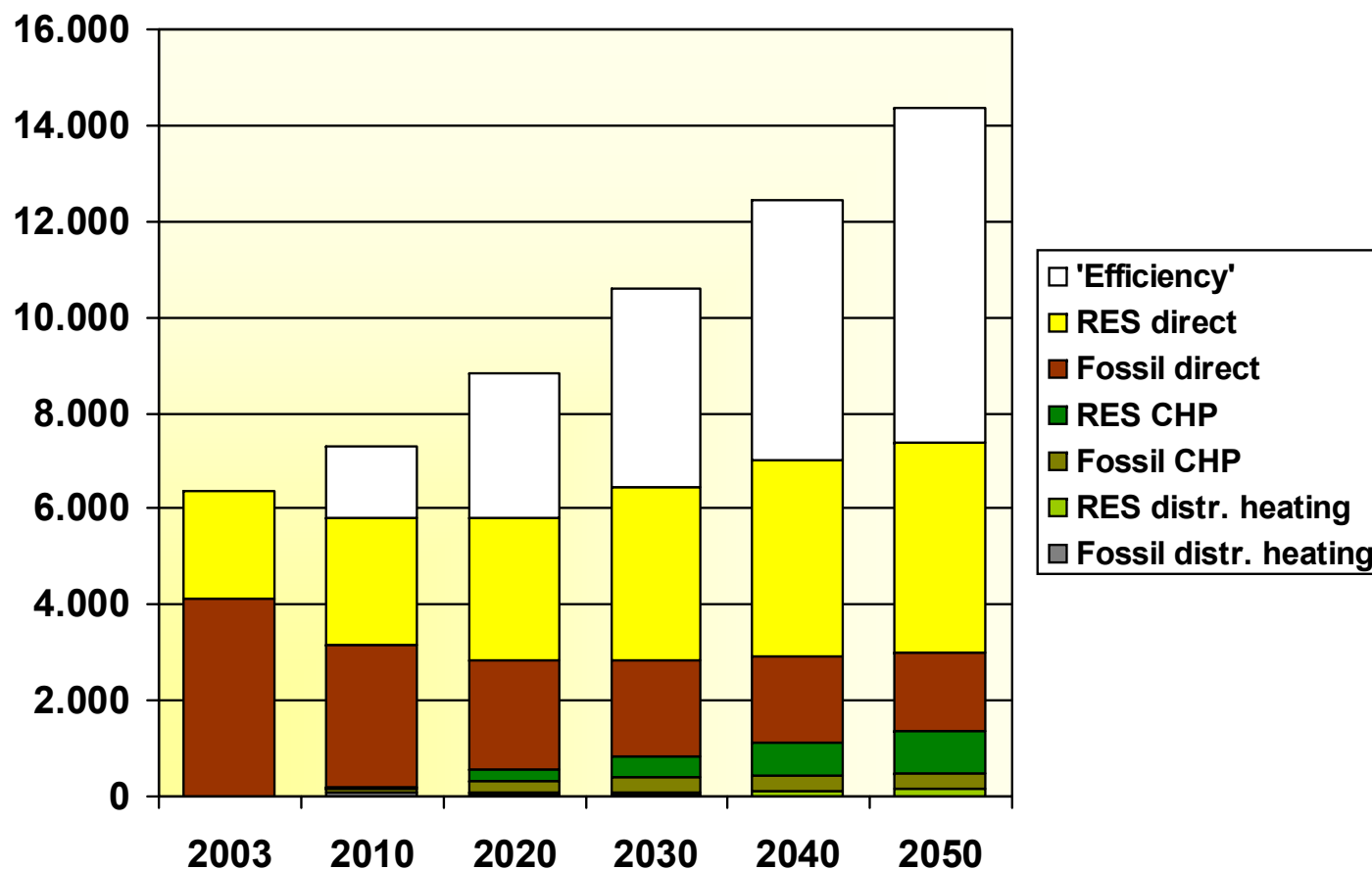
Growth of RES electricity generation under the “+2°C” Scenario, by individual sources



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



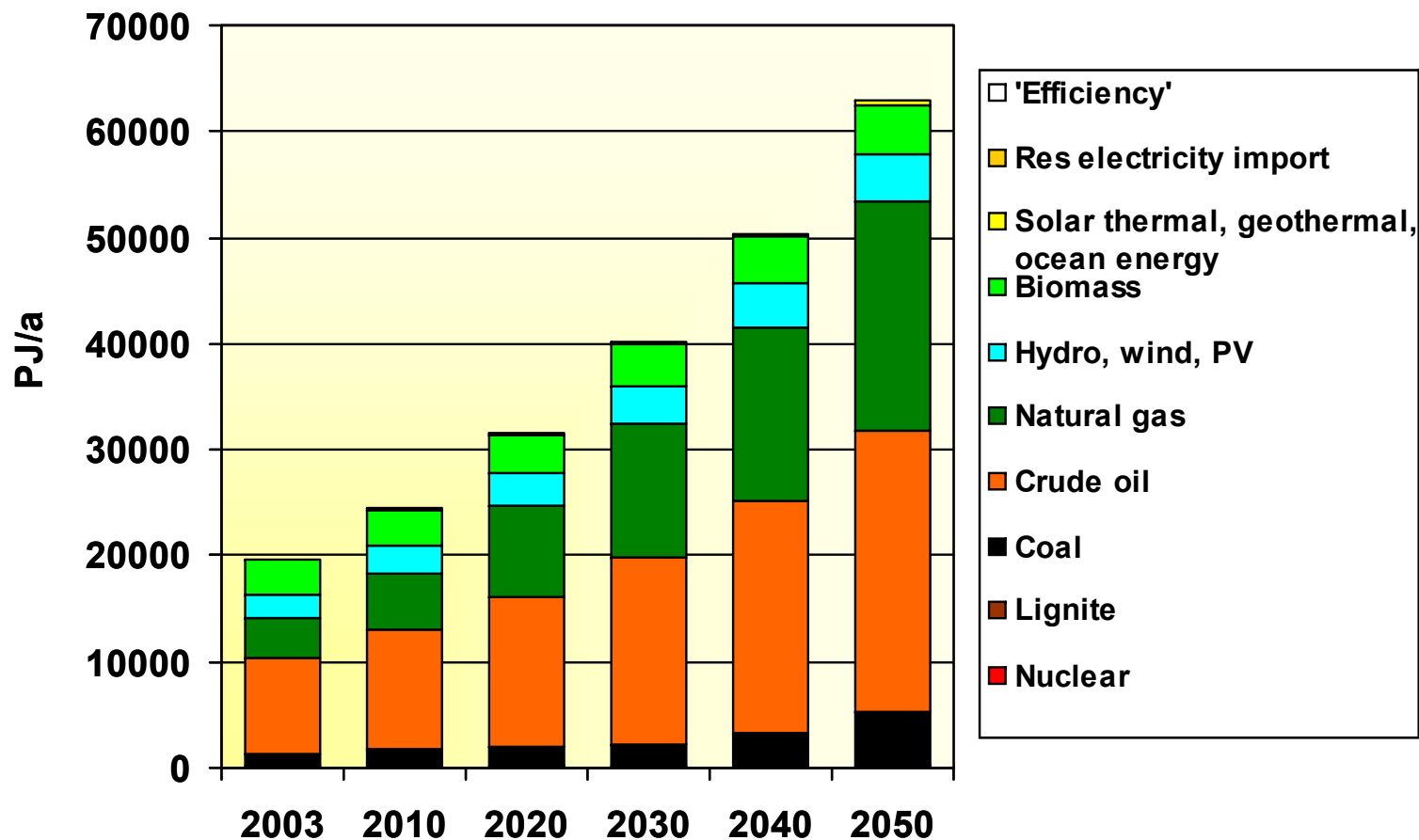
Development of the heat supply structure under the “+2°C” Scenario
(‘Efficiency’ = reduction compared to the Reference Scenario)



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



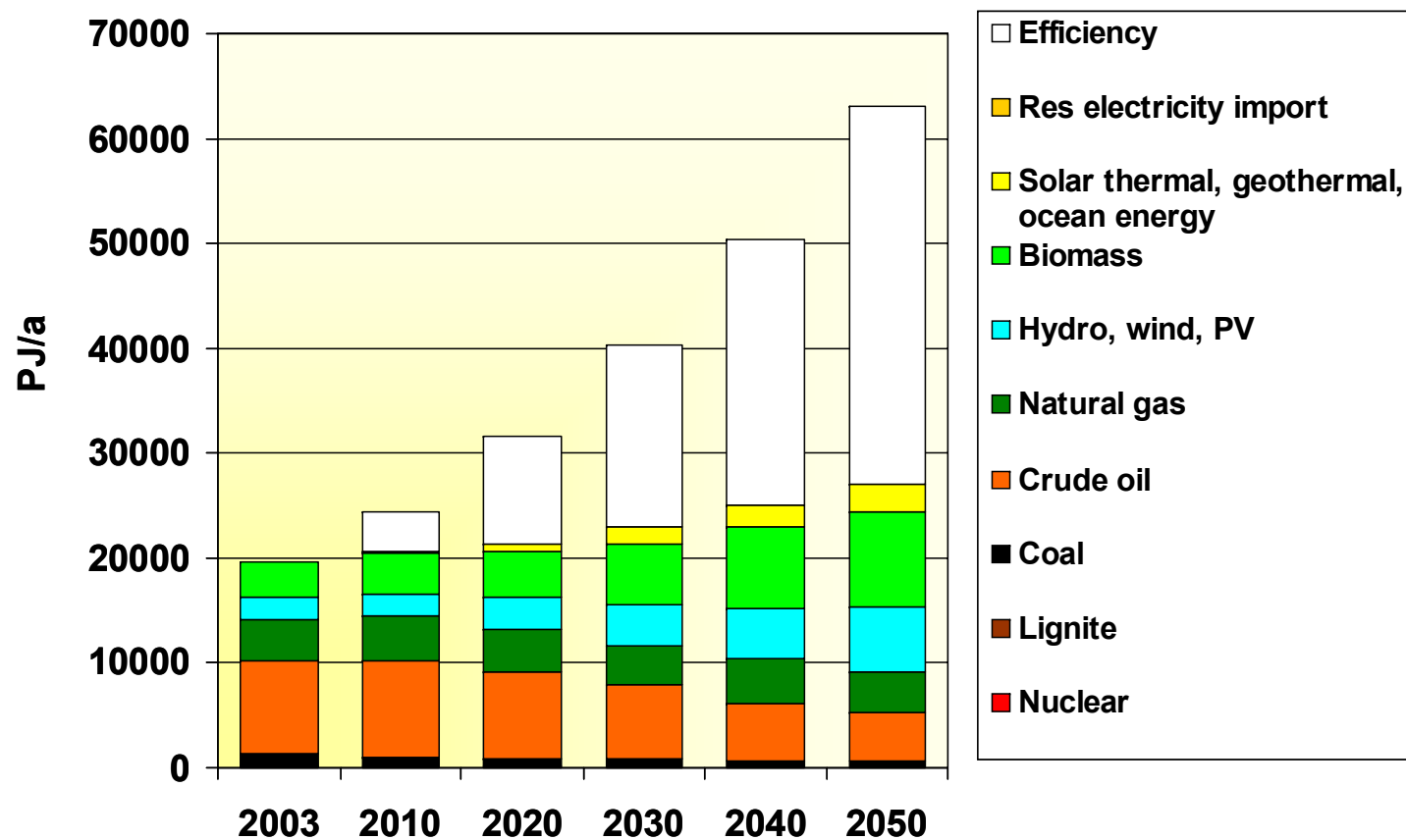
Development of primary energy consumption under the Reference Scenario



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



Development of primary energy consumption under the “+2°C” Scenario
(‘Efficiency’ = reduction compared to the Reference Scenario)



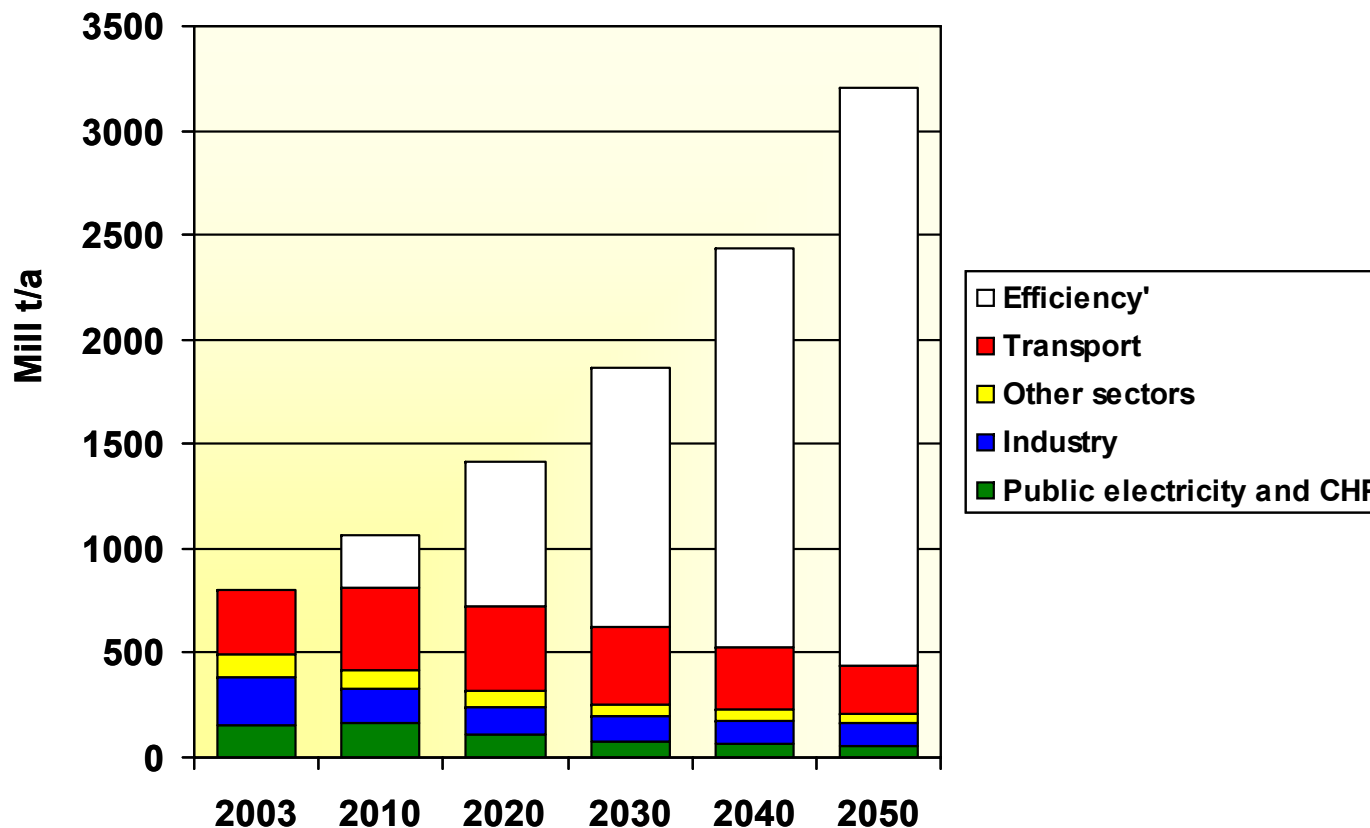
ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



Development of CO2 emissions in Latin America by sector under the “+2°C Scenario”

Reduction compared to 2003: - 45%

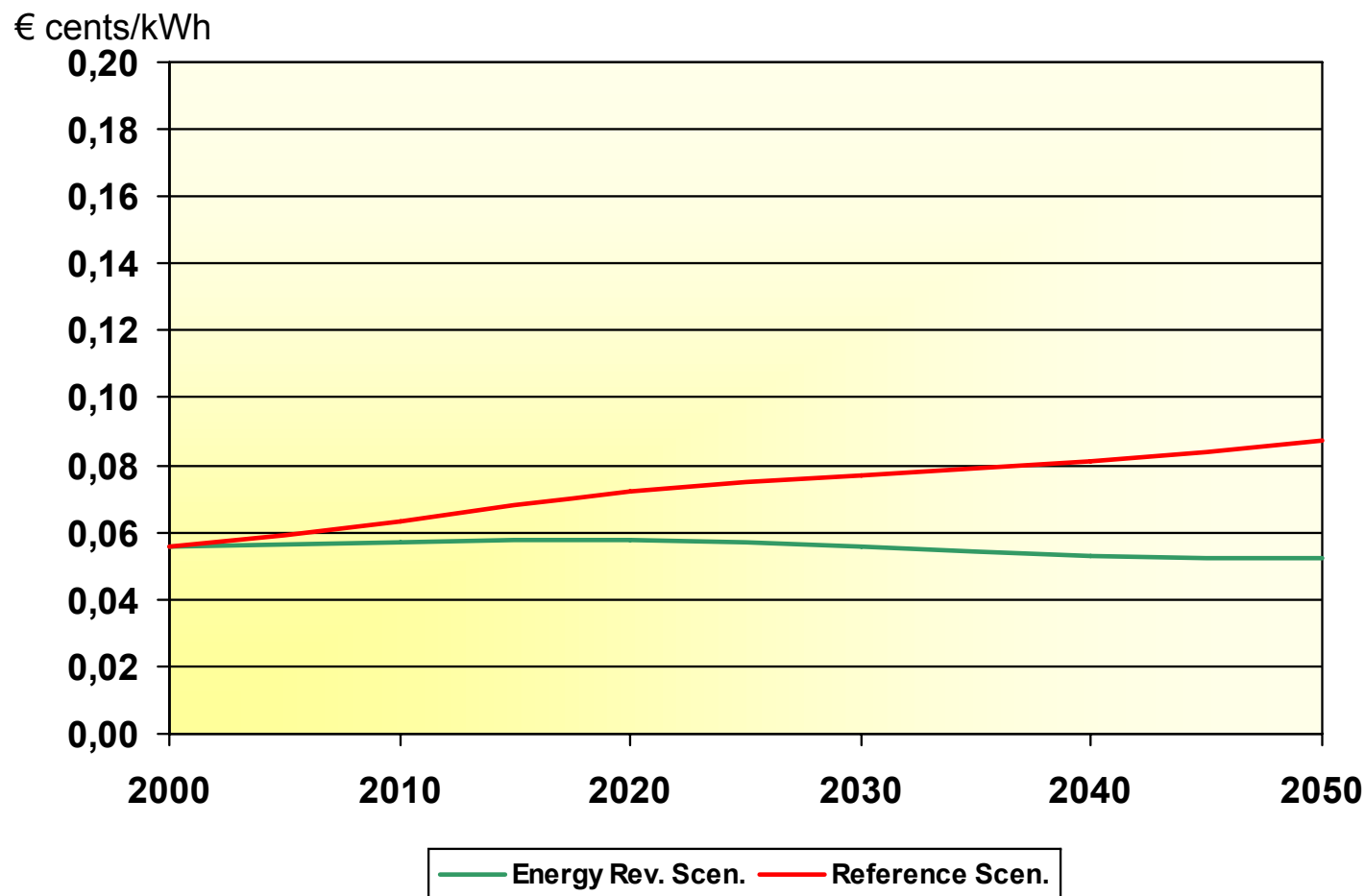
(‘Efficiency’ = reduction compared to the Reference Scenario)



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



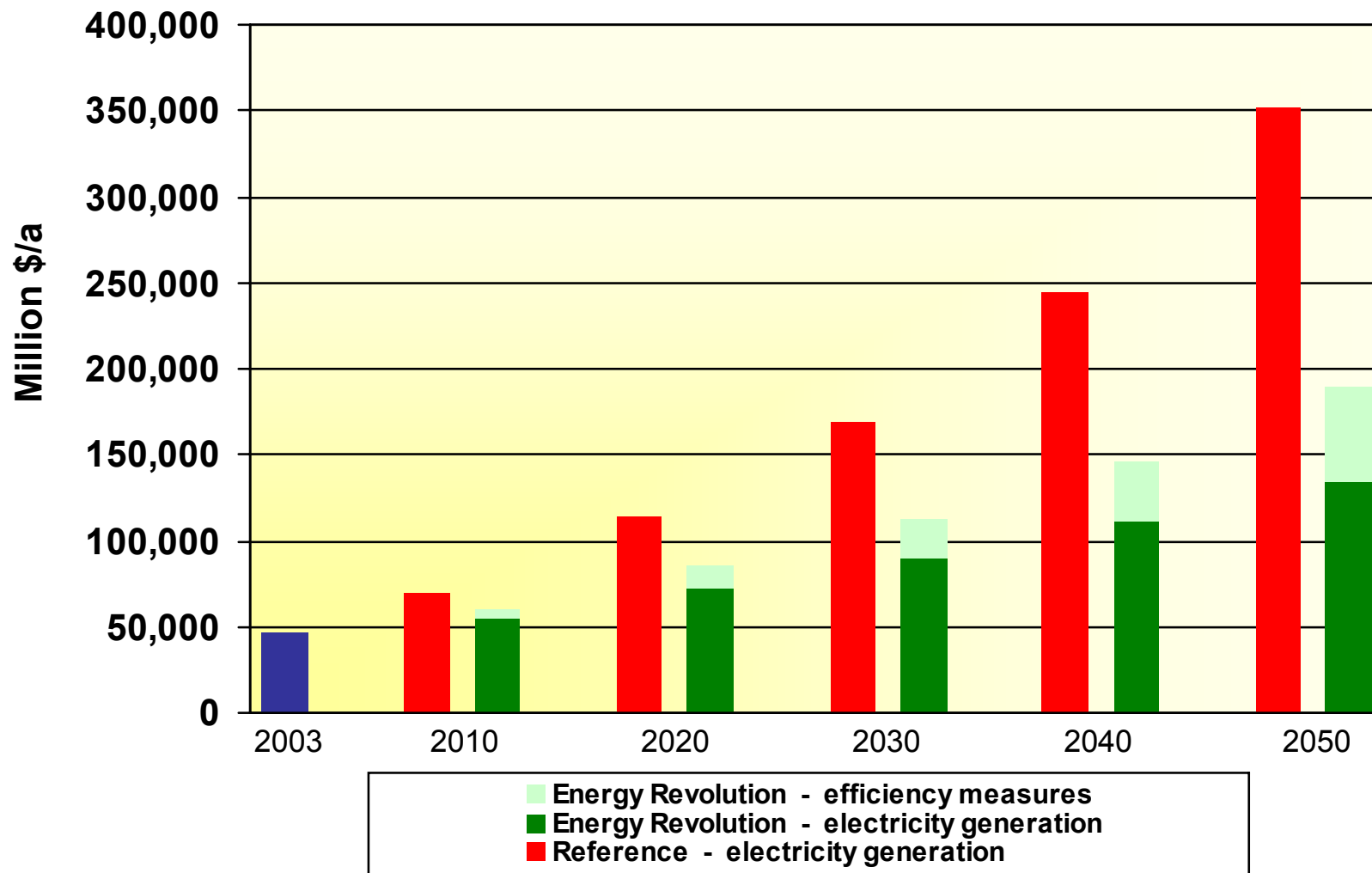
Development of specific electricity generation costs under the two scenarios
(CO₂-emission costs imposed in 2020 increase from 20 \$/tCO₂ in 2020 to 50 \$/tCO₂ in 2050)



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE



Development of total electricity supply costs



ENERGY REVOLUTION:

A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



Basic Results

- Restructuring the energy supply system, under the given ambitious environmental targets is feasible
- Under a long-term perspective, an energy supply system based on renewable energy sources goes along with economic benefits
- Action for investment into RES-technologies is required now: investment cycles in the energy sector are particularly long
- A dynamic market growth for RES is required to run through the learning curve
- Make use of all RES options in a well balanced way – we need them all



ENERGY REVOLUTION:

A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



To make the Energy Revolution Scenario happen,

Greenpeace calls for

- set legally binding targets for renewable energy
- implement a balanced and timely mobilisation of clean technologies, which will depend on technical potentials, actual costs and cost reduction potentials.
- give renewable energy guaranteed and priority access to the grid
- shift their investment away from fossil and nuclear fuels, starting by eliminating direct and indirect subsidies to fossil fuels and nuclear power, which would save taxpayers' money



GREENPEACE

ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



.....Thanks!



GREENPEACE

ENERGY REVOLUTION:

A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



Renewable energy technology options

A broad range of technologies is available for using various forms of renewable energy, which differ with respect to:

- technical maturity
- areas of application → from kW to multi-MW
- performance → supply dependent as well as base load
- costs



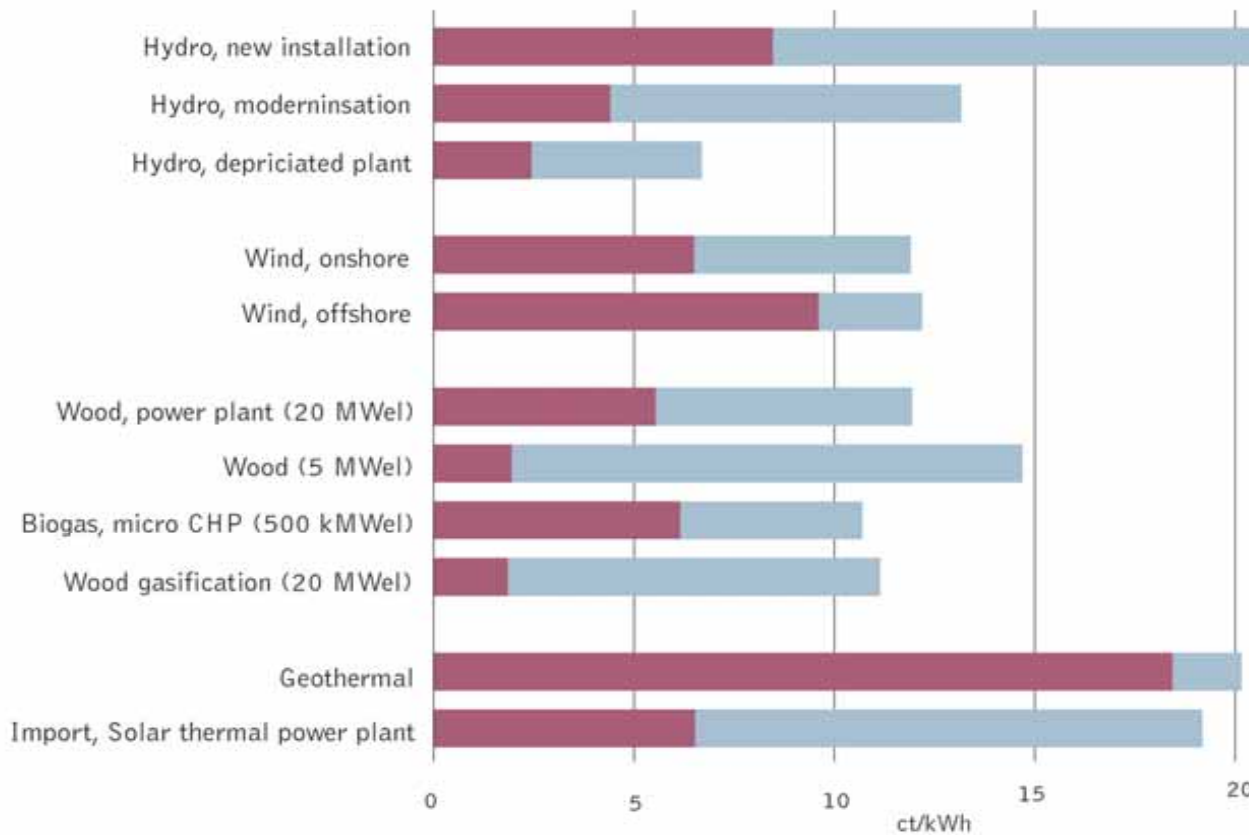
ENERGY REVOLUTION:

A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



Current Electricity Costs from Renewable Energy Sources

FIGURE 2: RANGE OF CURRENT ELECTRICITY-GENERATION COSTS FROM RENEWABLE ENERGY SOURCES (EXCLUDING PV WITH COSTS OF 45 TO 80 ct/kWh). COST DIFFERENCES REFLECT DIFFERENT LOCAL CONDITIONS, E.G WIND SPEED, SOLAR RADIATION, ETC.



. The current average electricity generation costs for new build fossil fuel power plants in Europe: 4 -5 cts/kWh.

. This does not include the uncertain fossil fuel costs.

. Most Renewable technologies, are not far away from being competitive already.

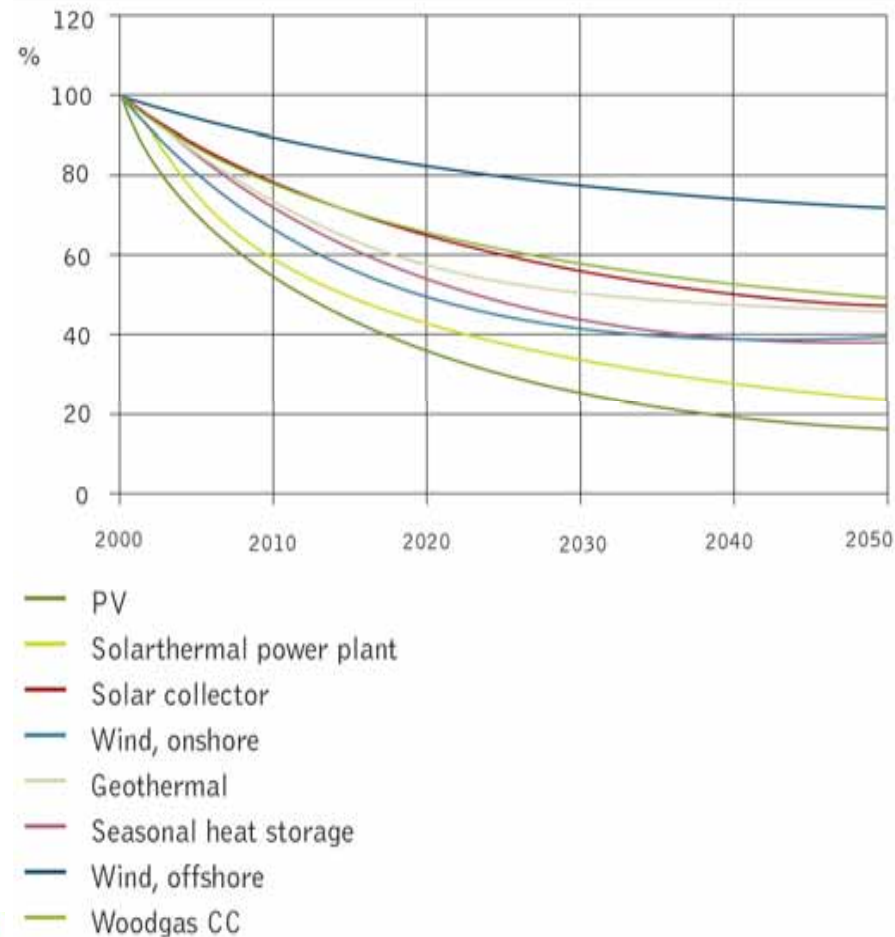


ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



Future Development of Specific Investment Costs for Renewables

FIGURE 3: FUTURE DEVELOPMENT OF SPECIFIC INVESTMENT COSTS (NORMALISED TO CURRENT LEVELS) FOR RENEWABLE ENERGY TECHNOLOGIES, DERIVED FROM LEARNING CURVES

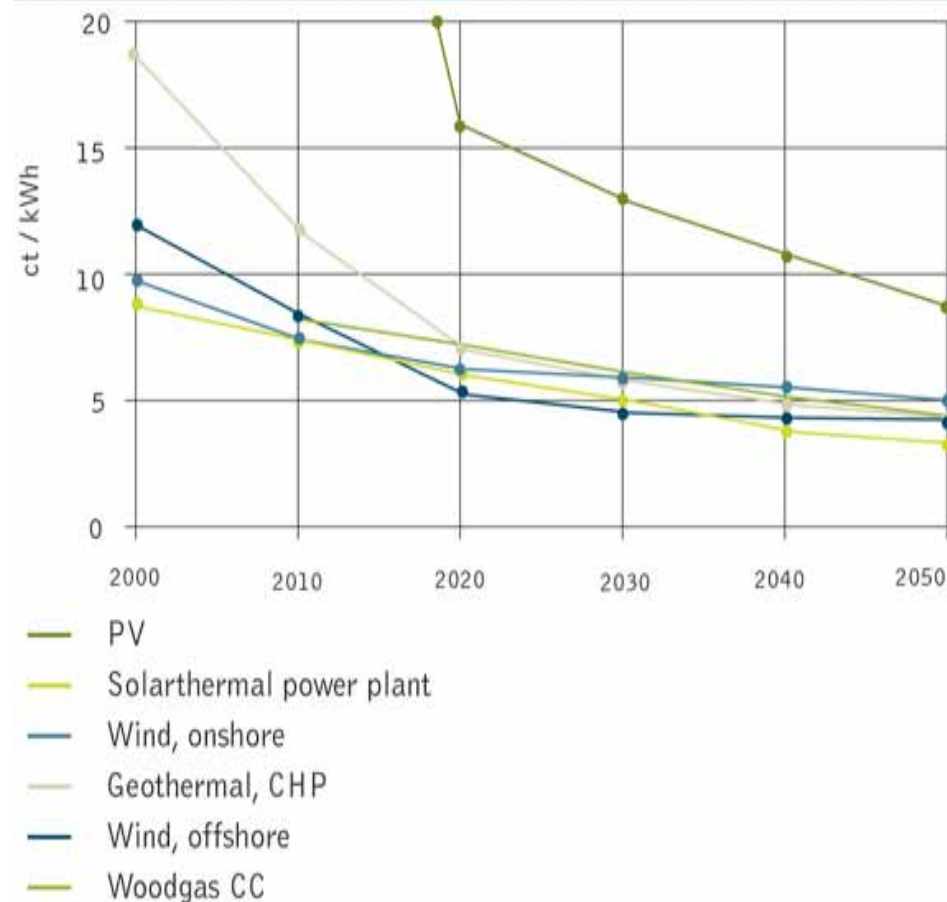


ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



Expected Development of Specific Electricity Generation Costs

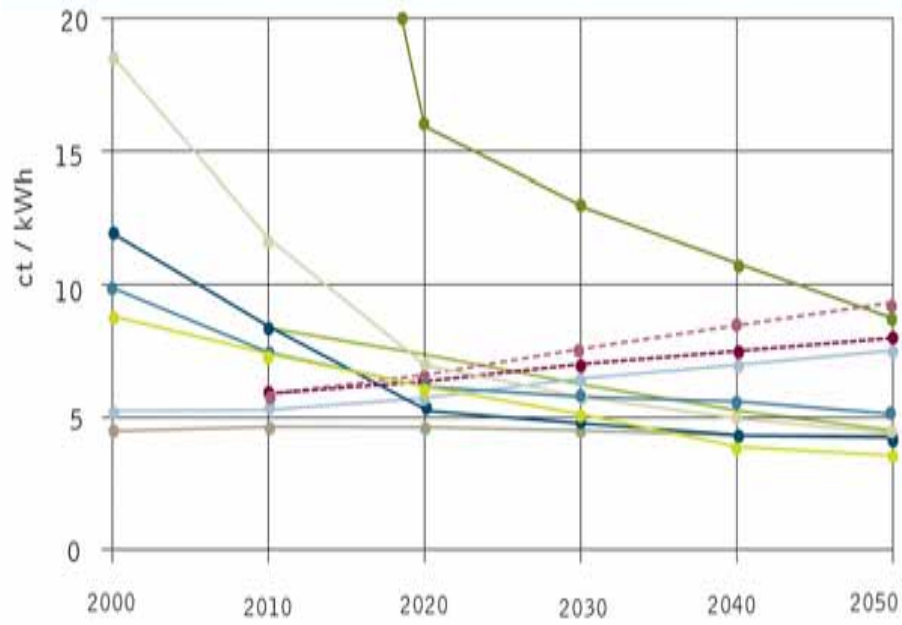
FIGURE 4: EXPECTED DEVELOPMENT OF SPECIFIC ELECTRICITY GENERATION COSTS FOR SELECTED RES-ELECTRICITY GENERATION TECHNOLOGIES. (NOTE: ELECTRICITY-GENERATION COSTS DEPEND PARTLY ON SITE-SPECIFIC FUEL COSTS AND HEAT CREDITS.)



ENERGY REVOLUTION: A SUSTAINABLE PATHWAY TO A CLEAN ENERGY FUTURE FOR EUROPE



FIGURE 6: EXPECTED DEVELOPMENT OF ELECTRICITY-GENERATION COSTS FROM FOSSIL AND RENEWABLE OPTIONS



Source: DLR, 2005

- PV
- Wind, offshore
- Gas CC
- - - Gas CC with CO₂ costs
- Coal
- - - Coal with CO₂ costs
- Geothermal
- Wind, onshore
- Solarthermal power plant
- Woodgas CC

Expected Development of Specific Electricity Generation Costs Renewables versus Fossil Fuels

- Depending on the energy policy and fossil fuel costs, renewable energies will reach the break even point within the next decade.