

INFORSE Vision 2050

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World Vision 2050

The world energy system

- ❖ is beyond the environmental limits
- ❖ does not provide basic energy needs as light and healthy cooking facilities to 1/4 of the world's population
- ❖ Environmental imperative: keep global warming to 1°C in 21. century (1.6°C above pre-industrial)
- ❖ Social imperative: provide all with basic energy needs and allow developing countries to develop, including use of cheap energy supply

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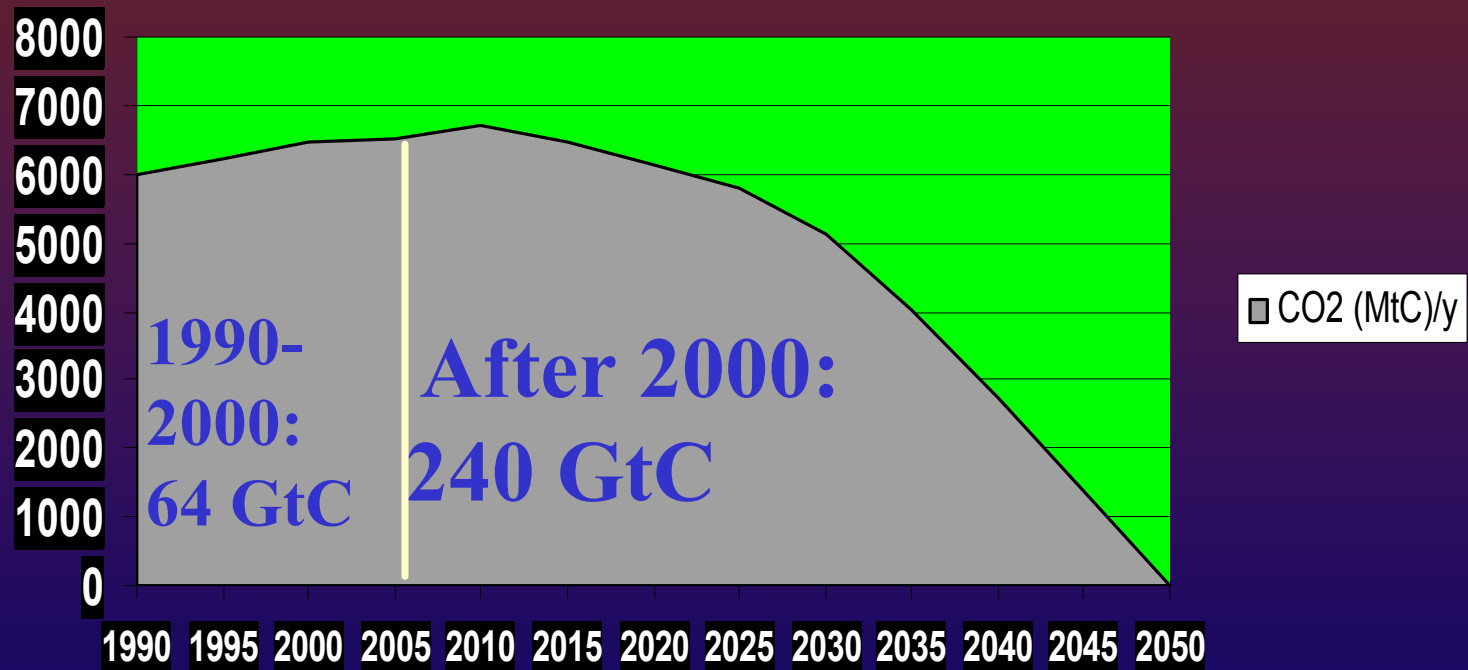
International Network for Sustainable Energy - Europe

Environmental Imperative

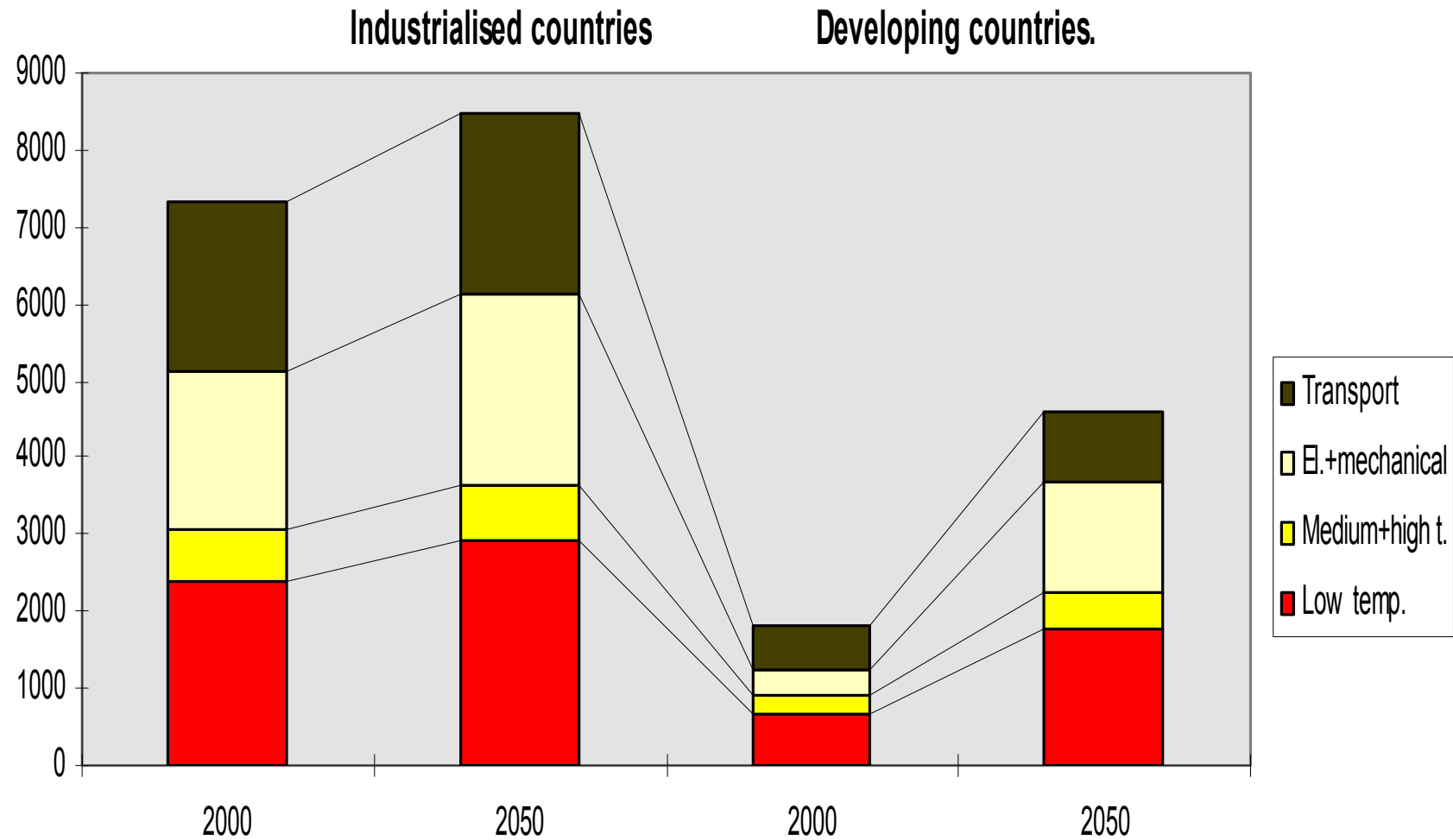
- ❖ To be sure to keep global warming below 1 °C during the 21. century, we must limit global CO₂ emissions to 225 Gigaton of Carbon in this century = 35 years of current consumption (assumed climate sensitivity of 3.5°C)

A Global Sustainable Scenario

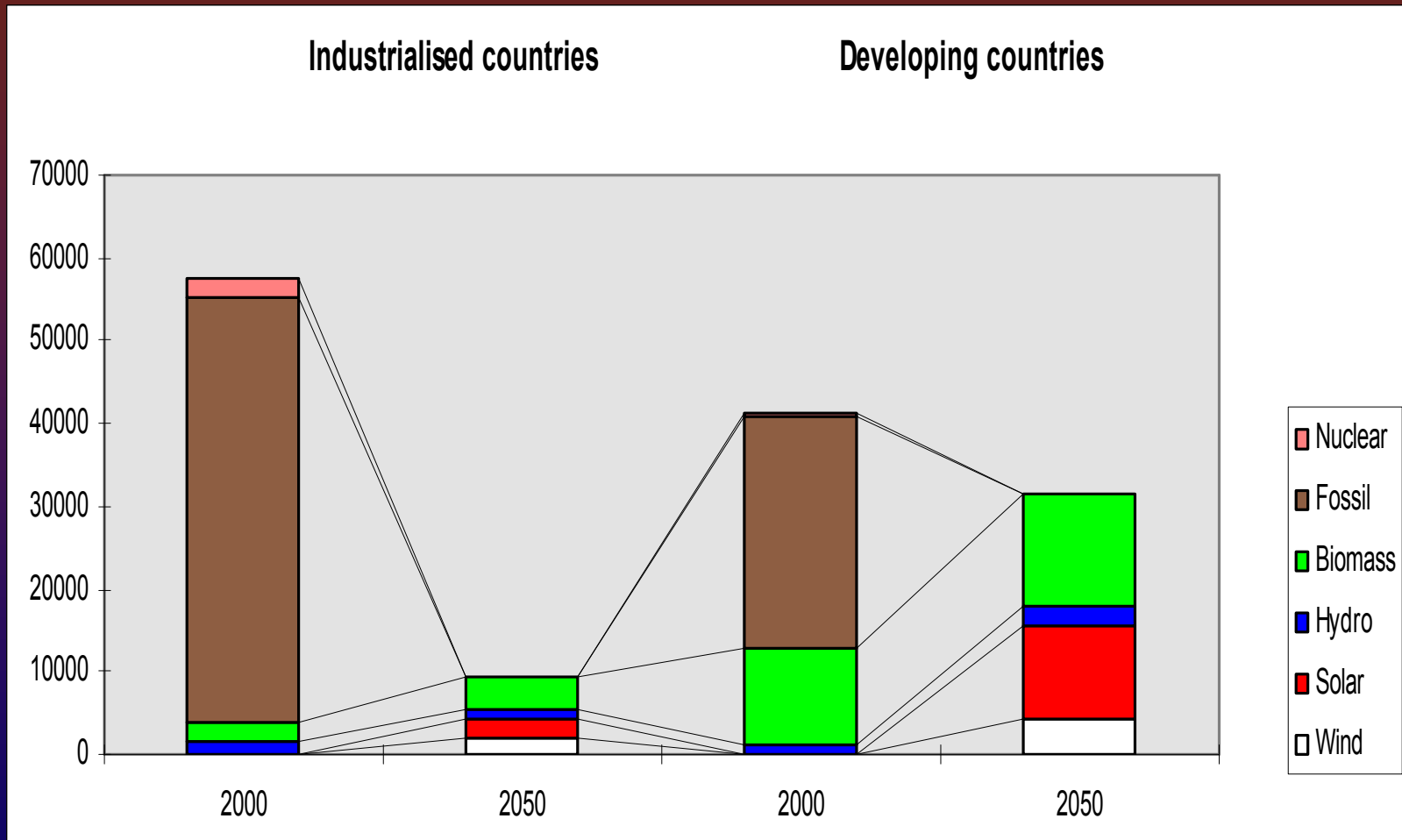
CO₂ (MtC)/y



Energy Services per capita



Primary Energy (TWh/y)



Energy Supply

Wind: Follow Windforce10/12 growth from 15,000 MW in 2000 to reach 3.000.000 MW in 2040, then maybe less afterwards

Large windpower development programs are cost-effective: extra costs today will be paid back with future cost reductions due to technology learning. Some sites give cost-effective electricity today.

Solar: PV has reached the critical 500 MWp/year, and the growth around 25% pr. year follows this vision

Biomass and hydro: Increase 30-50% in total

Biomass can be used as transport fuel

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Energy Demand

- ❖ Most energy consuming equipment will be replaced any times before 2050: new generations of equipment should maximize efficiency. Technology learning drives prices down.
- ❖ One exception is houses. In EU houses could use only 1/7 of today's heat demand in 2050. This will require renovation/re-building of 2% p.a. / heat consumption 20-40 kWh/year per m²
- ❖ For transport is expected increase in conversion efficiency from today's 15-20% to 50%, and re-gain of "break energy": factor 4 efficiency increase
- ❖ Energy service demand will increase, also in industrialized countries

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Scenario Effects

- ❖ Electric grid remains
- ❖ Increase in energy storage demand
- ❖ Nuclear phase-out 2010-2030
- ❖ Fossil phase out until 2050
- ❖ Because of large learning rates for the new technologies, costs can be minimal.
- ❖ Energy service demand decoupled from GNP

A Vision for Europe

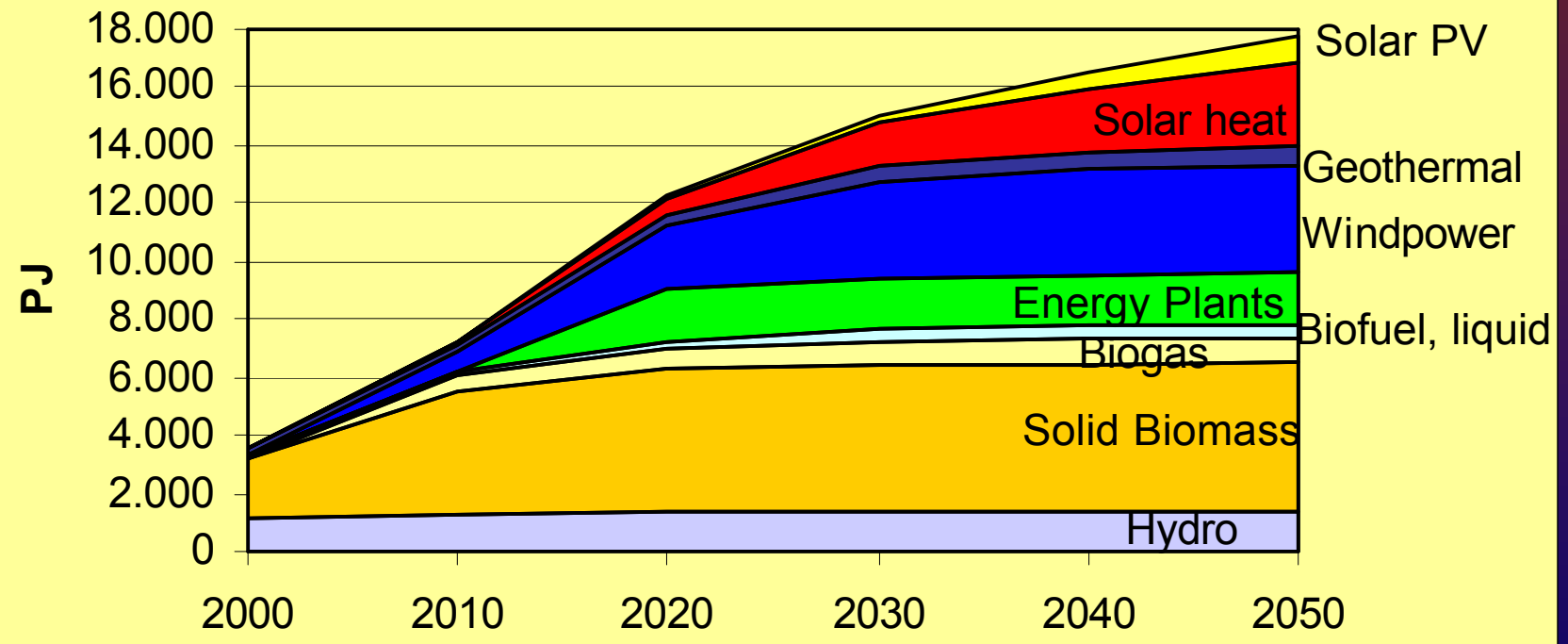
- ❖ White Paper for RE + more wind, less biomass, less solar
- ❖ Biomass follow WBGU sustainability limits
- ❖ of agricultural land 7% for solid biomass crops, 7% for extensive (1t/ha) liquid biofuels
- ❖ solar thermal + electric (mainly PV): 10 m²/person
- ❖ Factor 4 energy efficiency in transport, industry, electrical appliances
- ❖ 57% reduction in specific space heating
- ❖ CHP, flexible el.use: heat pumps, hydrogen for transport
- ❖ sustainable transport system

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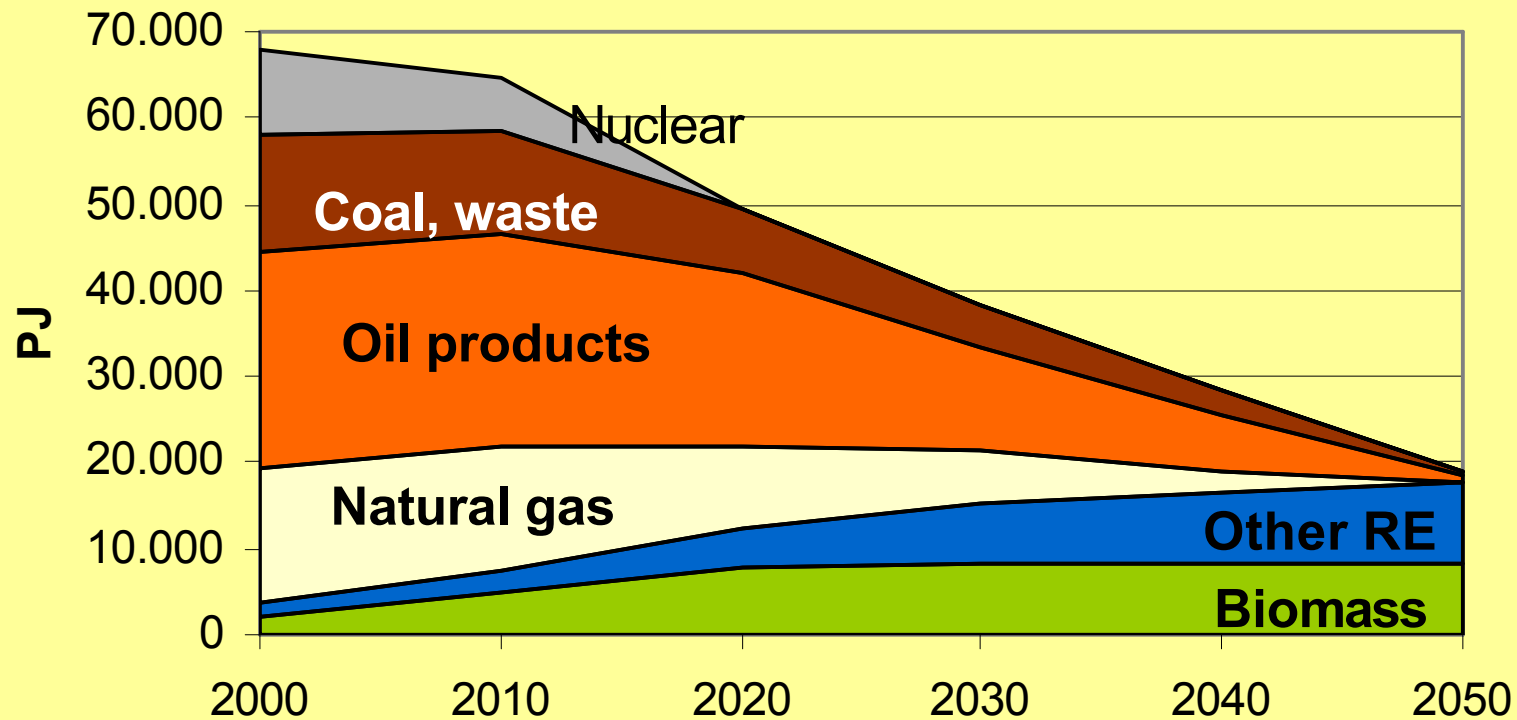
EU-25 Vision

Renewable Energy



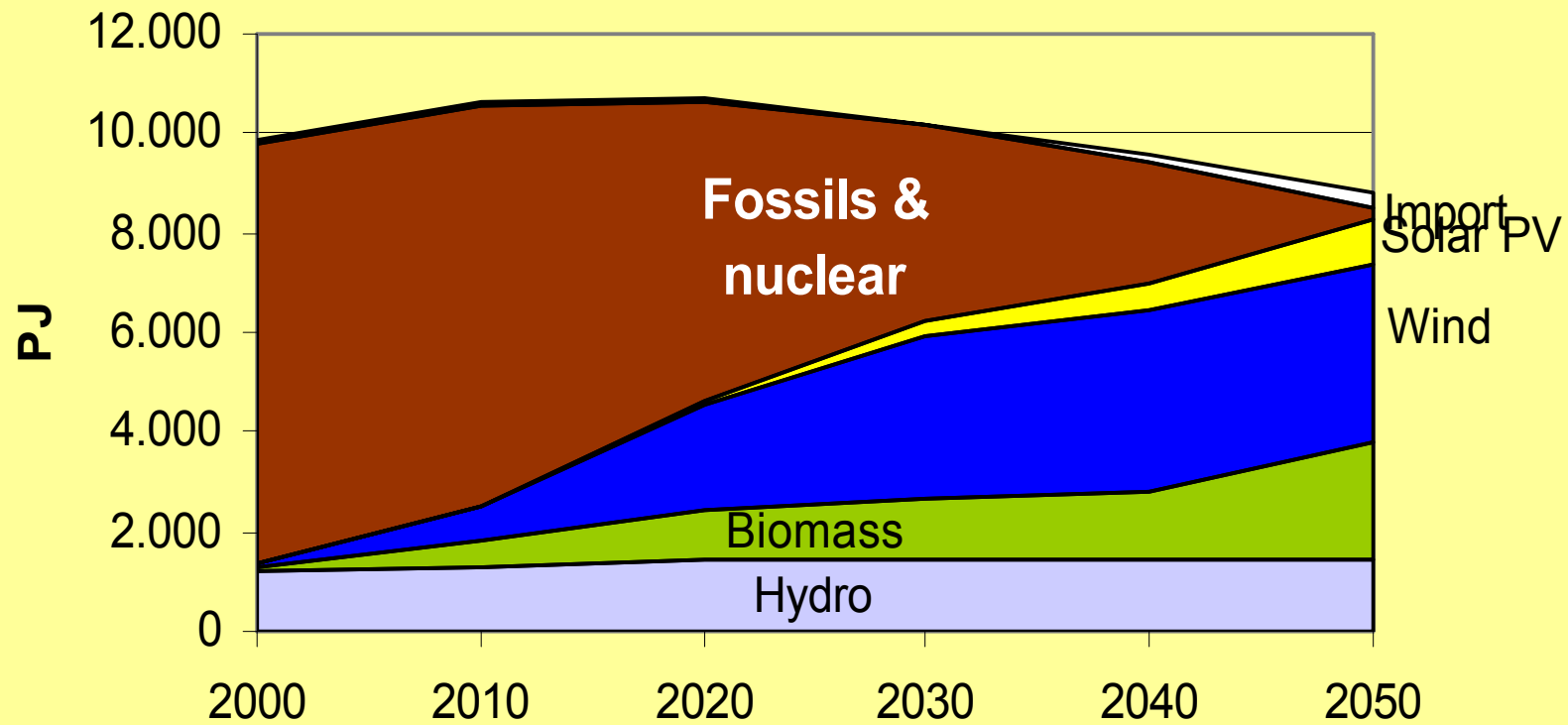
EU-25

Total Primary Energy Supply



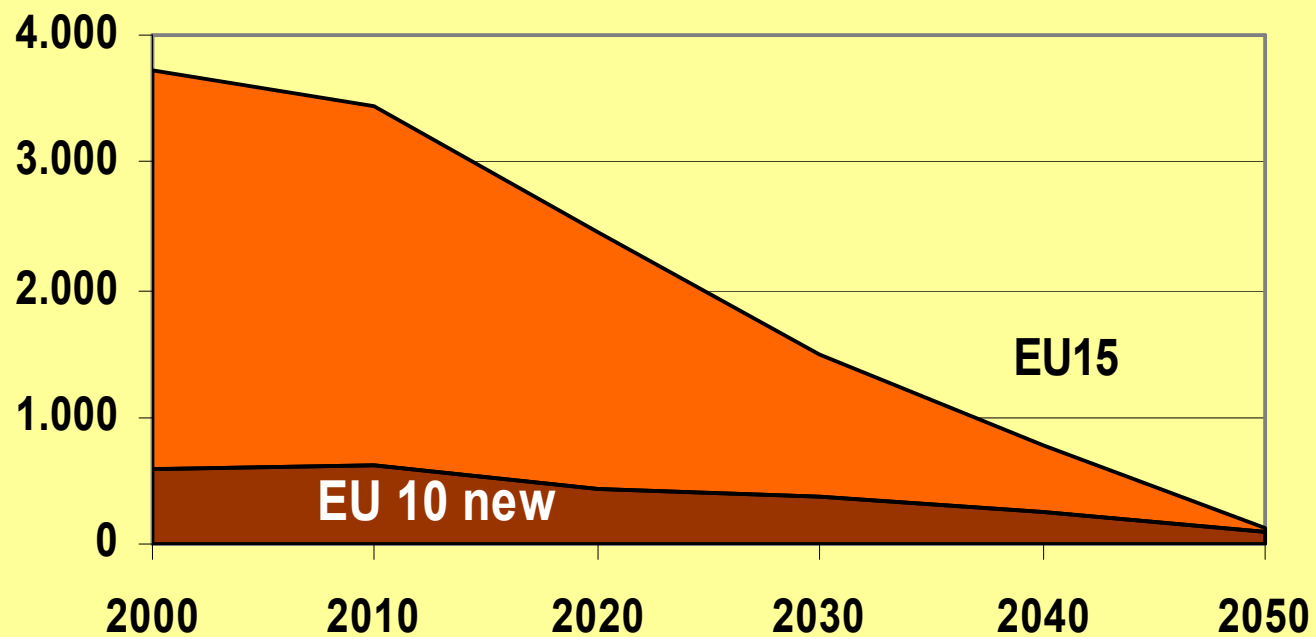
EU-25

Electricity Divided in Supply



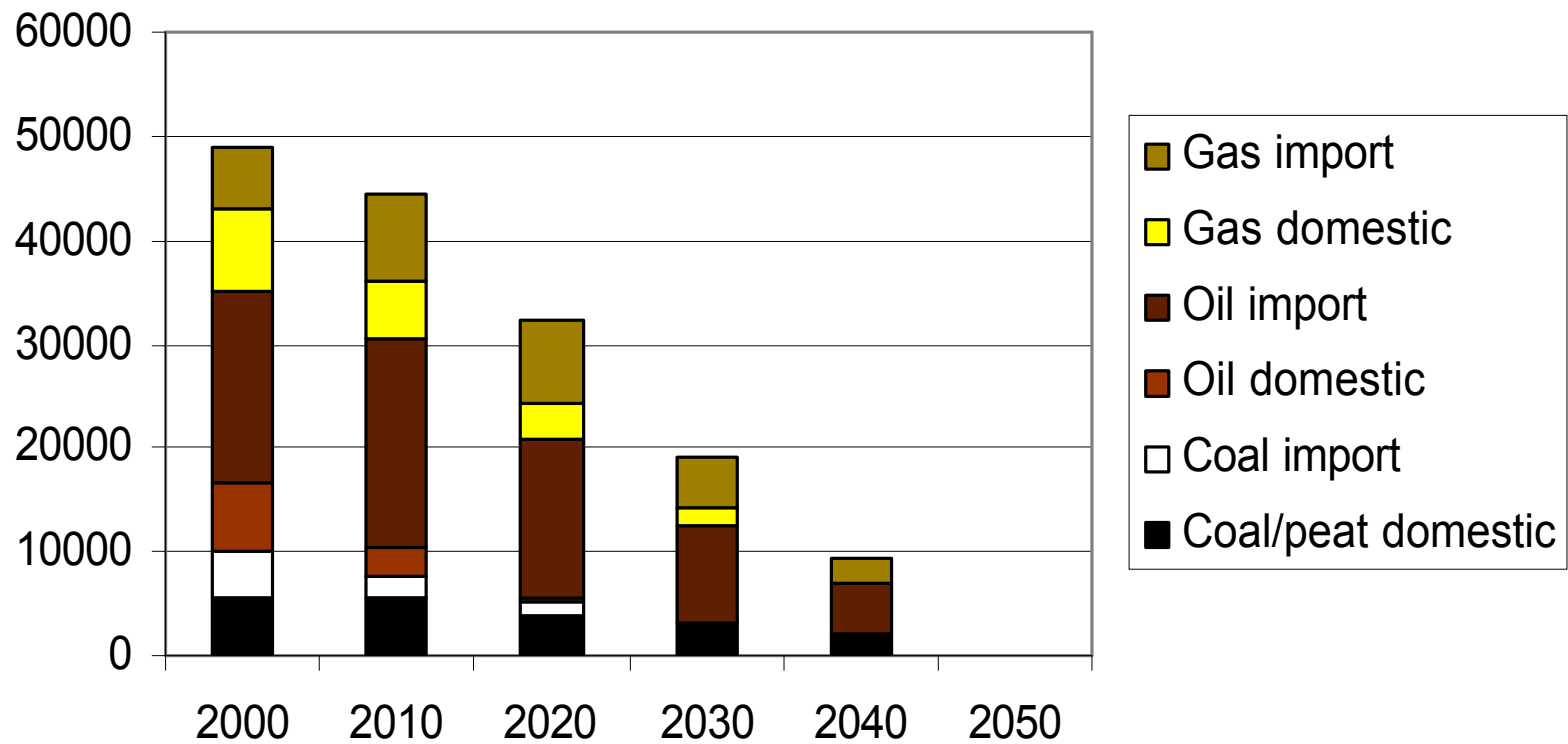
EU-25

CO₂ emissions, million tons/year



EU-15

Fossil fuel supply (PJ)

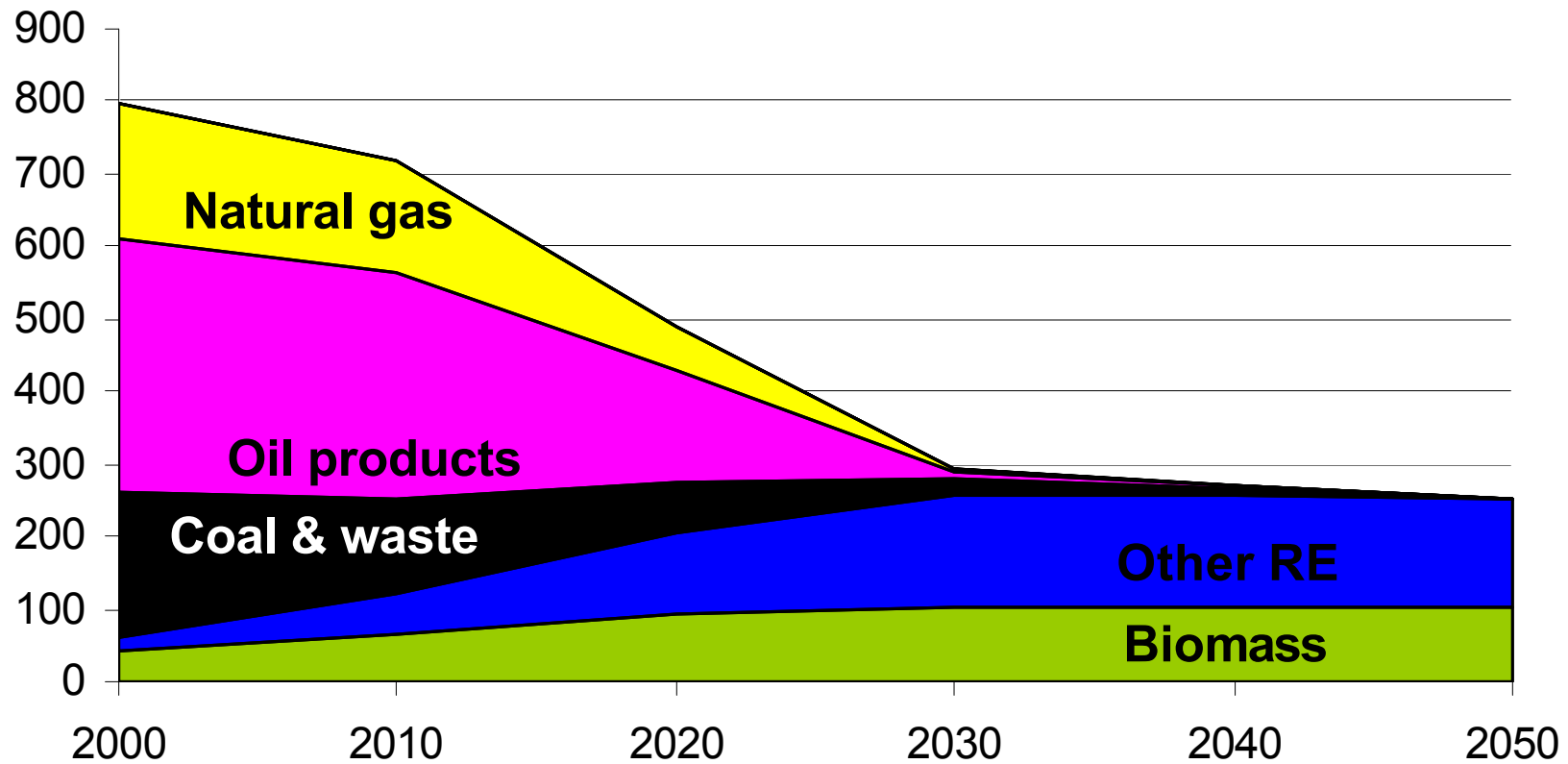


Vision for Denmark (OVE'05)

- ❖ Strong growth in windpower until 2030
- ❖ Half specific building consumption 2005-2025
- ❖ Flexible electricity use: heat pumps and hydrogen
- ❖ Sustainable transport system by 2030 (33% reduction in car use)
- ❖ el-storages from 2030

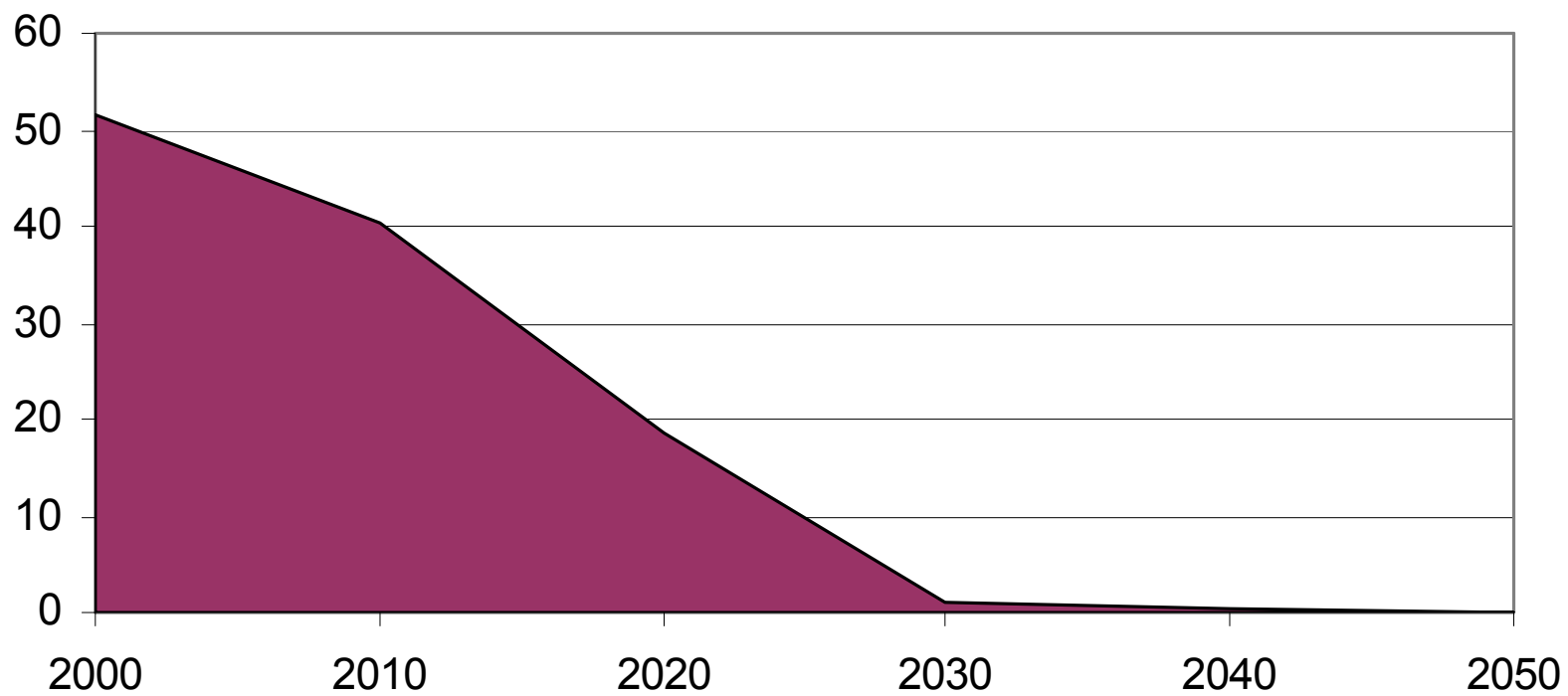


Primary Net Energy Supply, Denmark (PJ)



Vision for Denmark (OVE'05)

CO₂ from energy consumption mill. tons CO₂/year



Thank you

