



RETS
Renewable Energies Transfer System

Solar Photovoltaic, the German example

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Forecasts of experts

"I think there is a world market for maybe five computers."

Thomas Watson, chairman of IBM, 1943



"There is no reason for any individual to have a computer in his home."

Ken Olsen, American engineer who co-founded Digital Equipment Corporation (DEC), 1977

"The worldwide demand for motor vehicles will not exceed one million - solely because of the lack of available drivers."

Gottlieb Daimler, pioneer of automobile development and inventor of the first high-speed petrol engine





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Almost all the forecasts and scenarios in the past 30 years have grossly **misjudged the renewable energies.**

- the potential and
- the speed of development



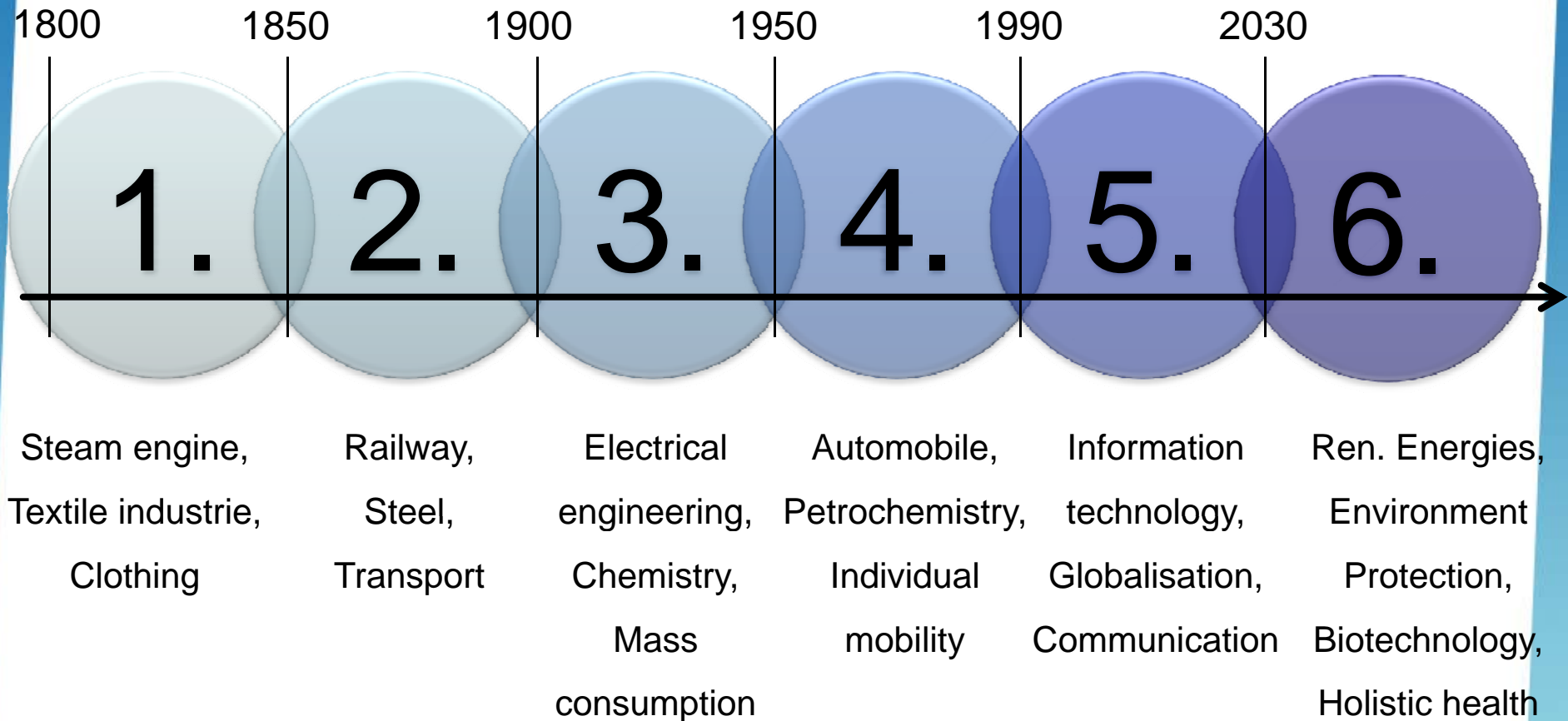
This was due to the pessimistic assumptions in the forecasts.

*Source: Erneuerbare Energien - Vorhersage und Wirklichkeit
Vergleich von Prognosen und Szenarien mit der
tatsächlichen Entwicklung Erneuerbarer Energien.
Deutschland - Europa - Welt
Kurzgutachten, Mai 2009, Agentur für Erneuerbare Energien e.V.*



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Kondratieff-cycles — long waves of economic situation





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Renewables Global Status Report 2011

- Continued **global growth** of renewable energy in 2010
- Renewable energy supplied approx. **16% of global final energy consumption**
- **Solar PV more than doubled** in comparison with 2009
- Solar PV capacity was added in **more than 100 countries**.
- **Germany installed more PV in 2010** than the world in 2009
- **Global Investments** up over 30% to a record \$211 billion



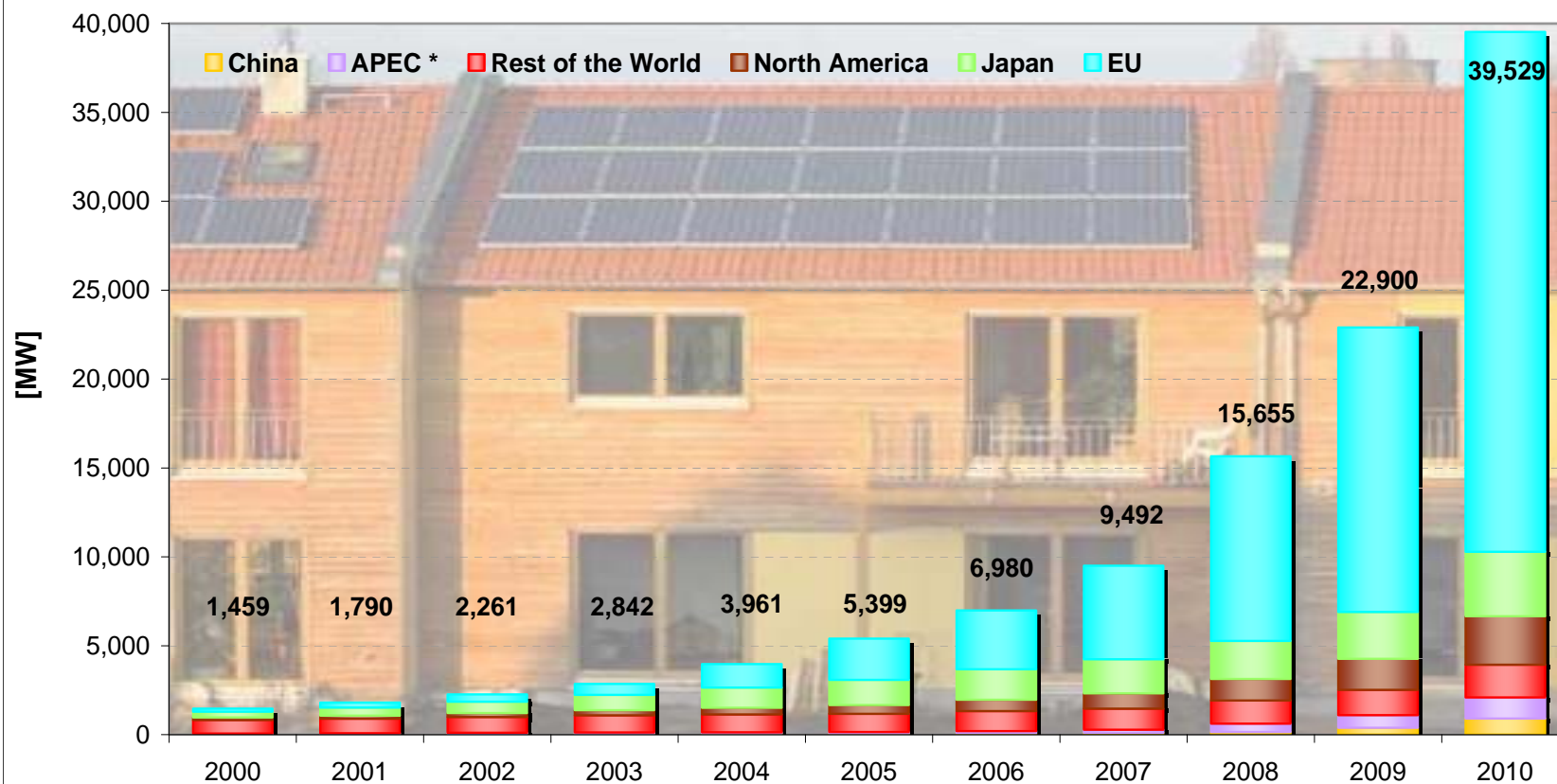
Source: REN21, Global Status Report 2011

- **The United Nations have put renewable energy at the top of its agenda in 2012**
- **The world now has more renewable energy capacity in place than nuclear power**



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Worldmarket photovoltaics 2000 - 2009 cumulated installed capacity



Members of Asia-Pacific Economic Cooperation (APEC) are: Australia, Brunei, Canada, Indonesia, South Korea, Malaysia, New Zealand, The Philippines, Singapore, Thailand, USA, Panama, Taiwan, Hongkong, Mexico, Papua New Guinea, Chile, Peru, Russia, Vietnam plus China and Japan, visualised separately.

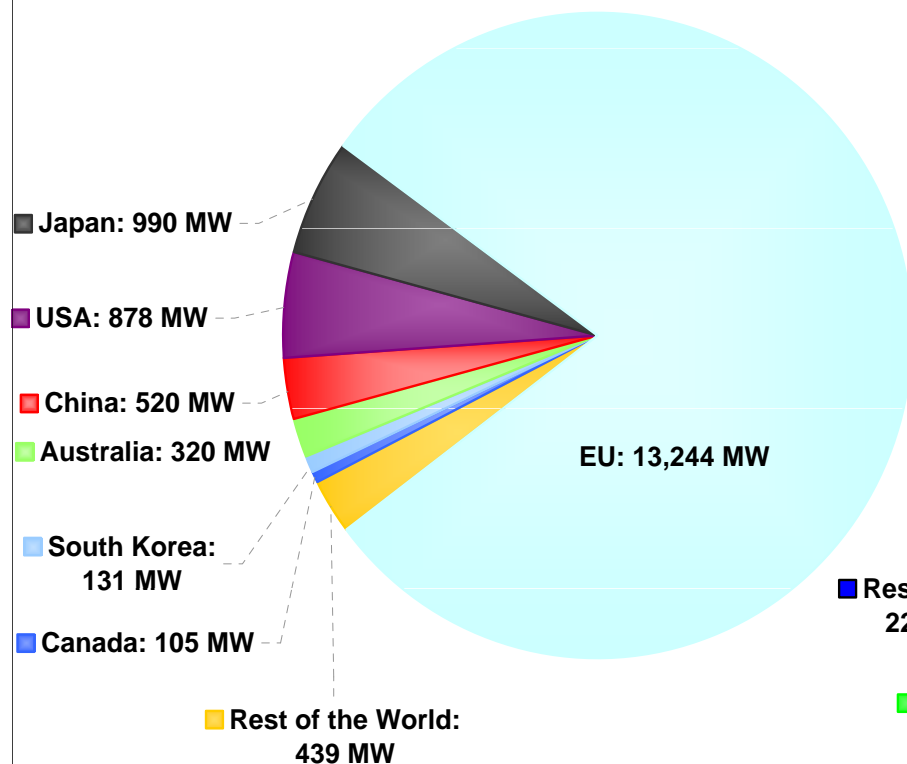
Source: European Photovoltaik Industry Association (EPIA): "Global Market Outlook for Photovoltaics until 2015"; Image: BMU / Brigitte Hiss; as at: May 2011; all figures provisional



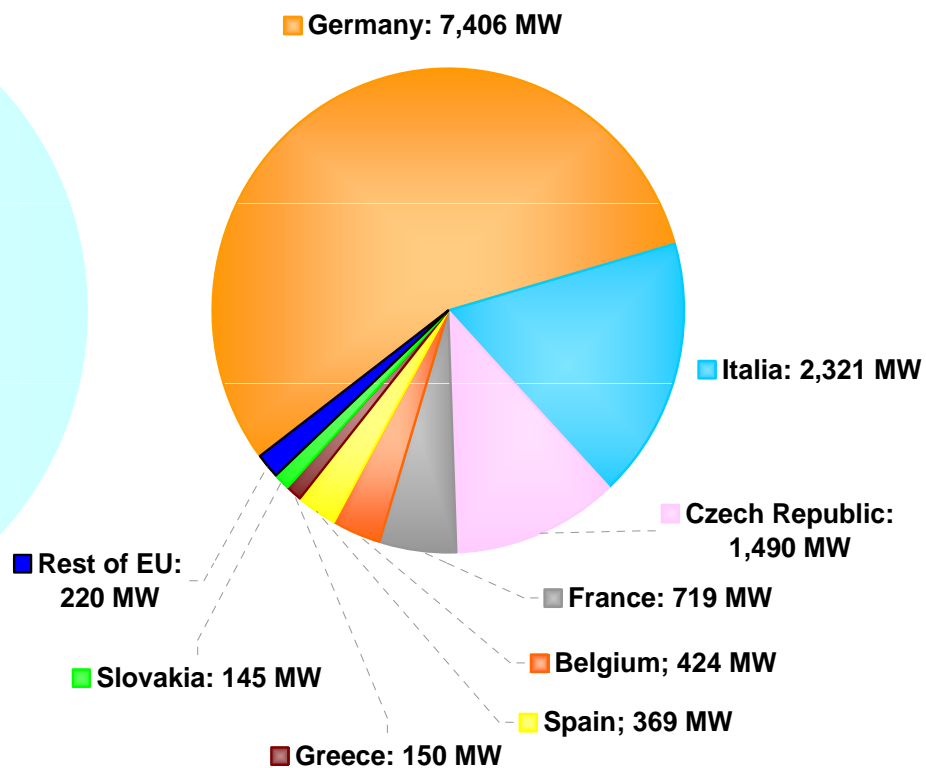
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Worldmarket photovoltaics, new installed capacity 2010

Total (world) 2009: 7.2 GW



Total (EU) 2009: 5.6 GW



Source: European Photovoltaik Industry Association (EPIA): "Global Market Outlook for Photovoltaics until 2015"; as at: May 2011; all figures provisional



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2. German context

2.1 Feed-In Tariff - Renewable Energy Sources Act / EEG

- **1990** Electricity Feed Act
- April **2000** Act came into force – success story started, **78 Countries** today
- Boom for several renewable energy technologies
- **Fierce opposition** against the law – 2001 positive decision of the European Court of Justice
- **First phase EEG, past 10 years:** different RES-industries and services were established
- **Second phase EEG, next 10 years:** issue of grid and system integration, grid expansion, storage capacity





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Feed-In Tariff

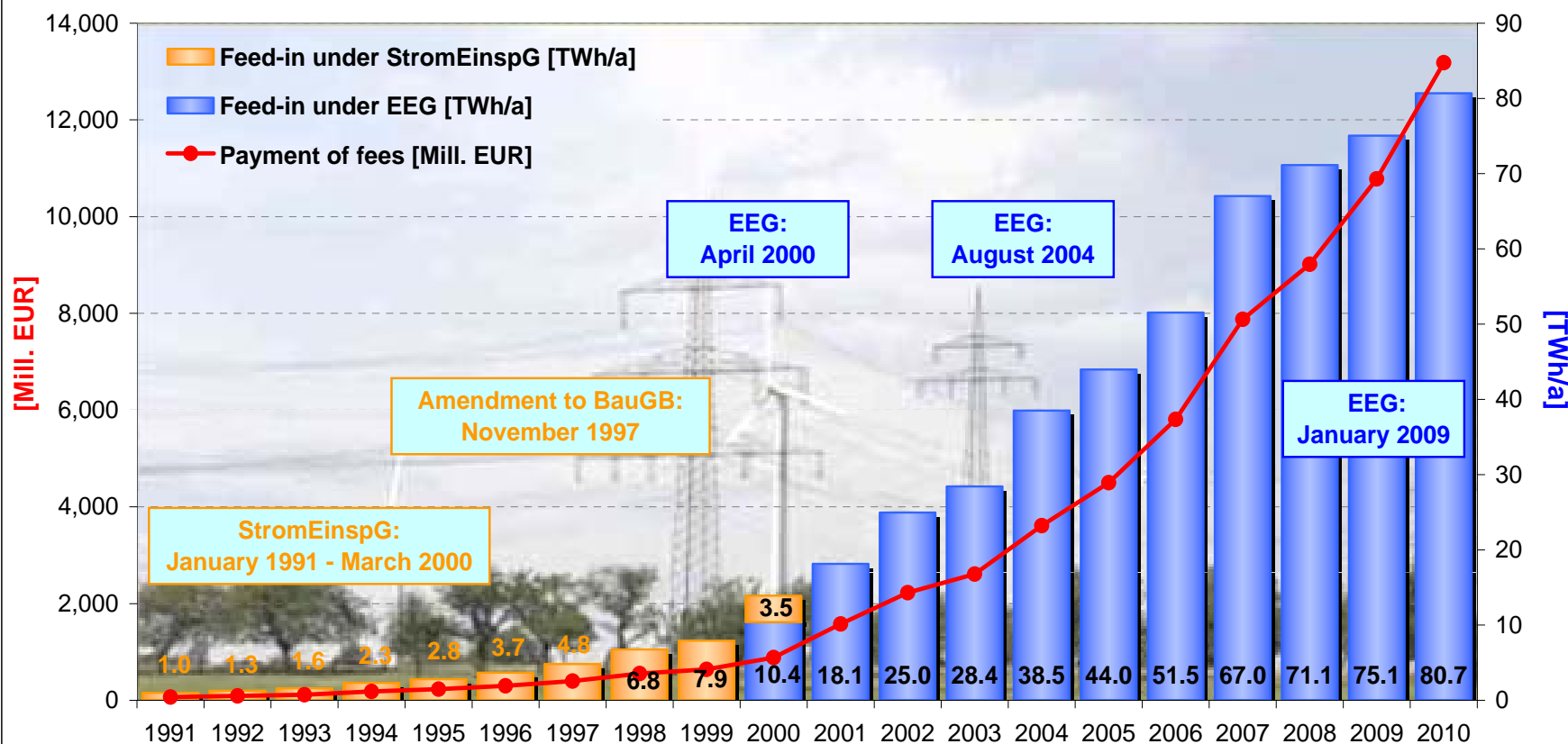


Key to success :

- The tariff is set at the **point of connection** to the grid.
- The level of the tariff is **guaranteed for 20 years**
> planning security + attractive investment in solar electricity systems.
- The cost of the feed-in tariff is **supported by all electricity users**
> it does not rely on State budgets
- The **simplicity** of the feed-in tariff concept and its **low administrative costs**
> it is a highly effective and efficient tool



Feed-in and payment under the Electricity Feed Act (StromEinspG) and the Renewable Energy Sources Act (EEG) in Germany



StromEinspG: Act on the Sale of Electricity to the Grid; BauGB: Construction Code; EEG: Renewable Energy Sources Act; 1 TWh = 1 Bill. kWh; Source: BMU-KI III 1 according to Working Group on Renewable Energy-Statistics (AGEE-Stat); Year 2010: provisional estimate (IfnE); image: BMU / Bernd Müller; as at: July 2011; all figures provisional

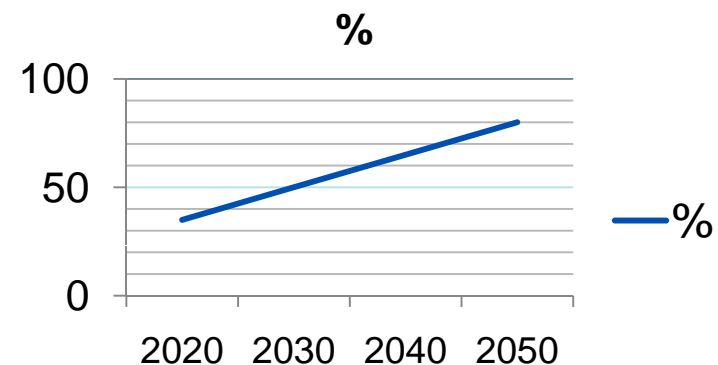


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2.2 Current development

- Germany is facing a **fundamental transformation of its energy supply**
- Electricity generation in **nuclear power plants will be phased out** by the end of **2022**.
- The **eight nuclear power plants** which were shut down **will not be reconnected** to the grid.
- **Renewable Energy Sources Act / EEG 2012:**
- Share of electricity produced from renewable energy sources:

▪ 2020	⇒	35 %
2030	⇒	50 %
2040	⇒	65 %
2050	⇒	80 %





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2.3 Public acceptance

- The German population stands fully behind the development of renewable energies.
- **94% of the respondents endorse the expansion of the renewable energies**
- **Which energy sources should Germany use after phasing out nuclear energy in 2022?**
 - > 23% coal
 - > 46% gas
 - > 94% renewable energies



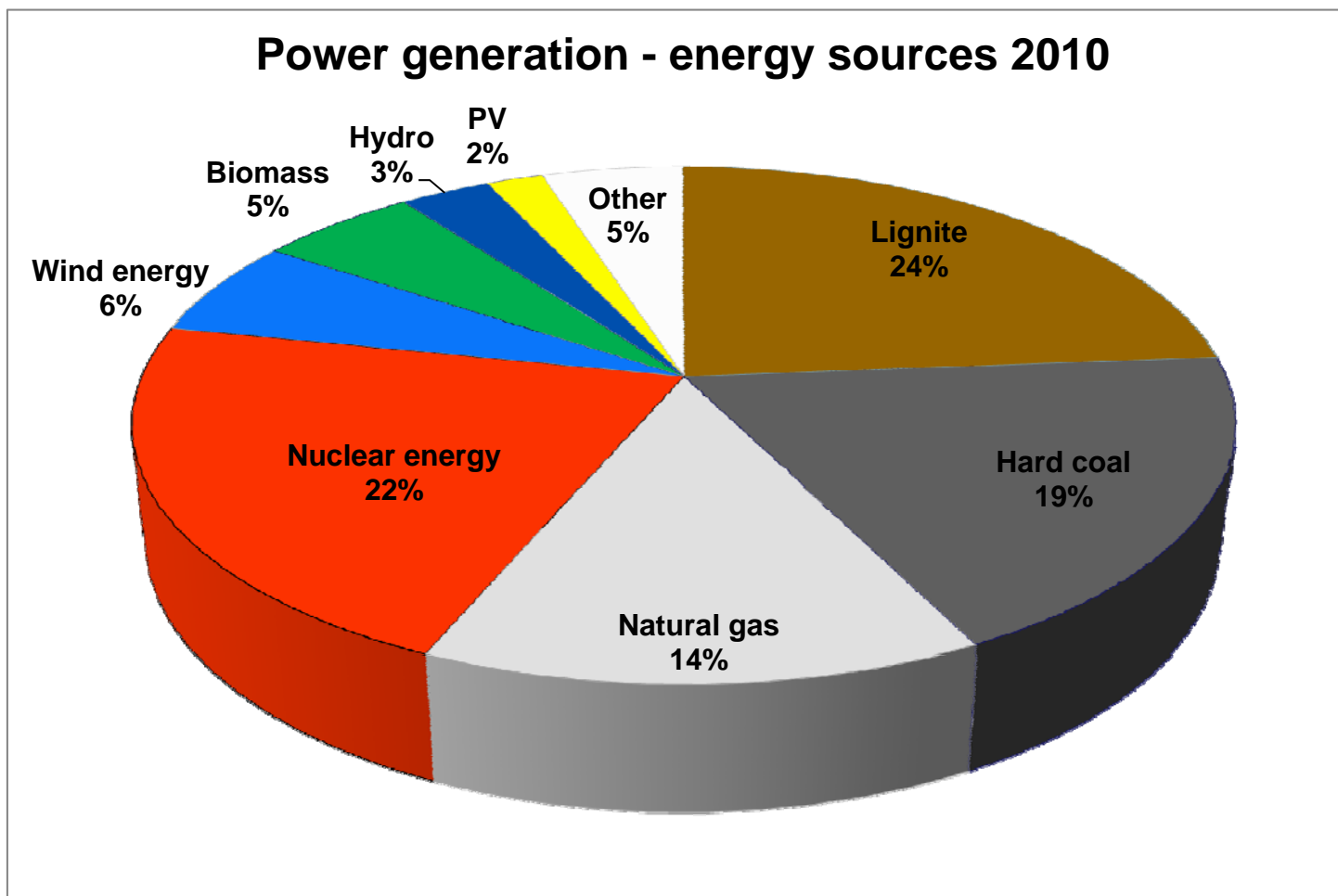
Source: Representative survey of infratest dimap by order of the WWF from 30. June to 2. July 2011

More and more private people and communities want to produce their own energy.

> independence and re-communalization of the public utility/networks

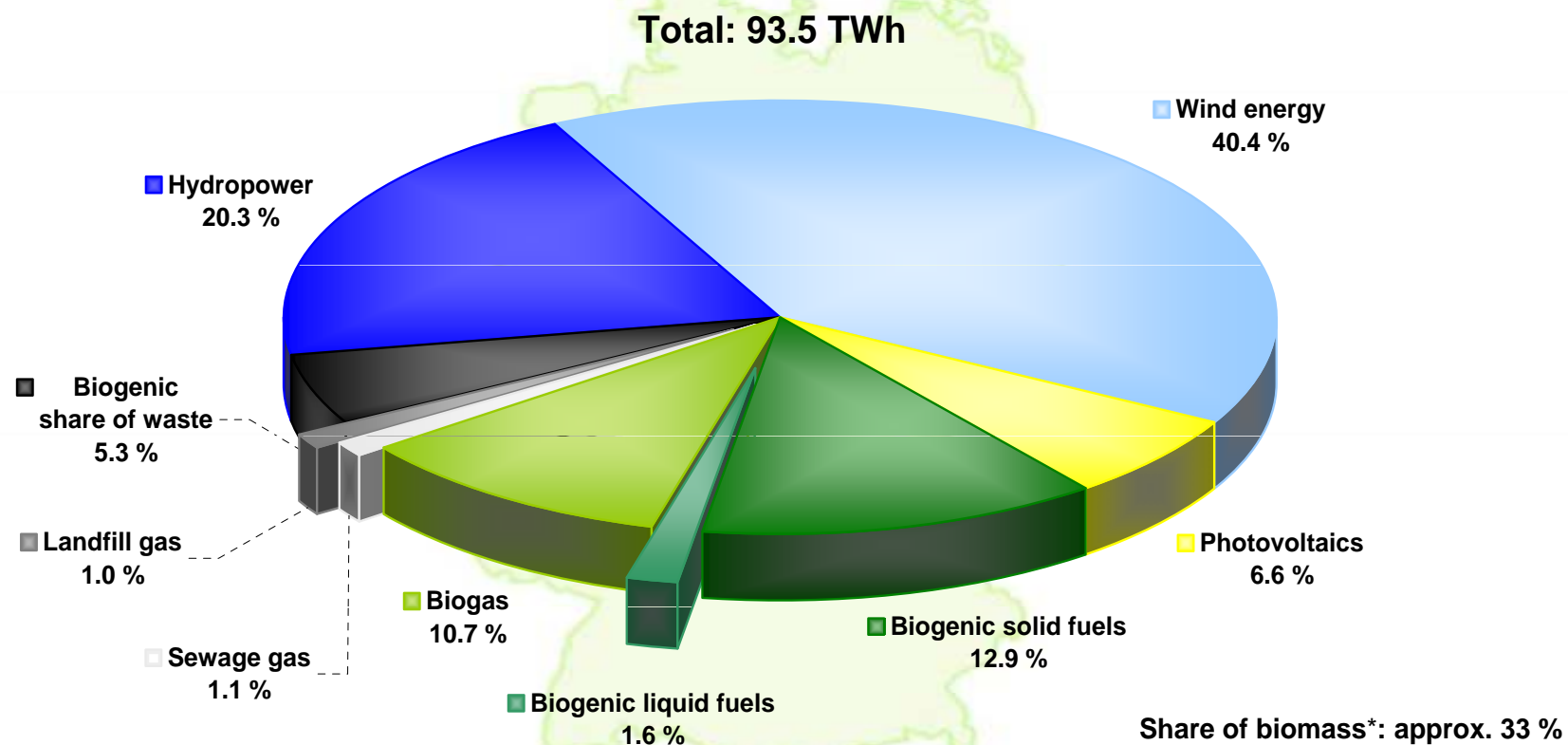


German power mix





Structure of electricity supply from renewable energy sources in Germany 2009

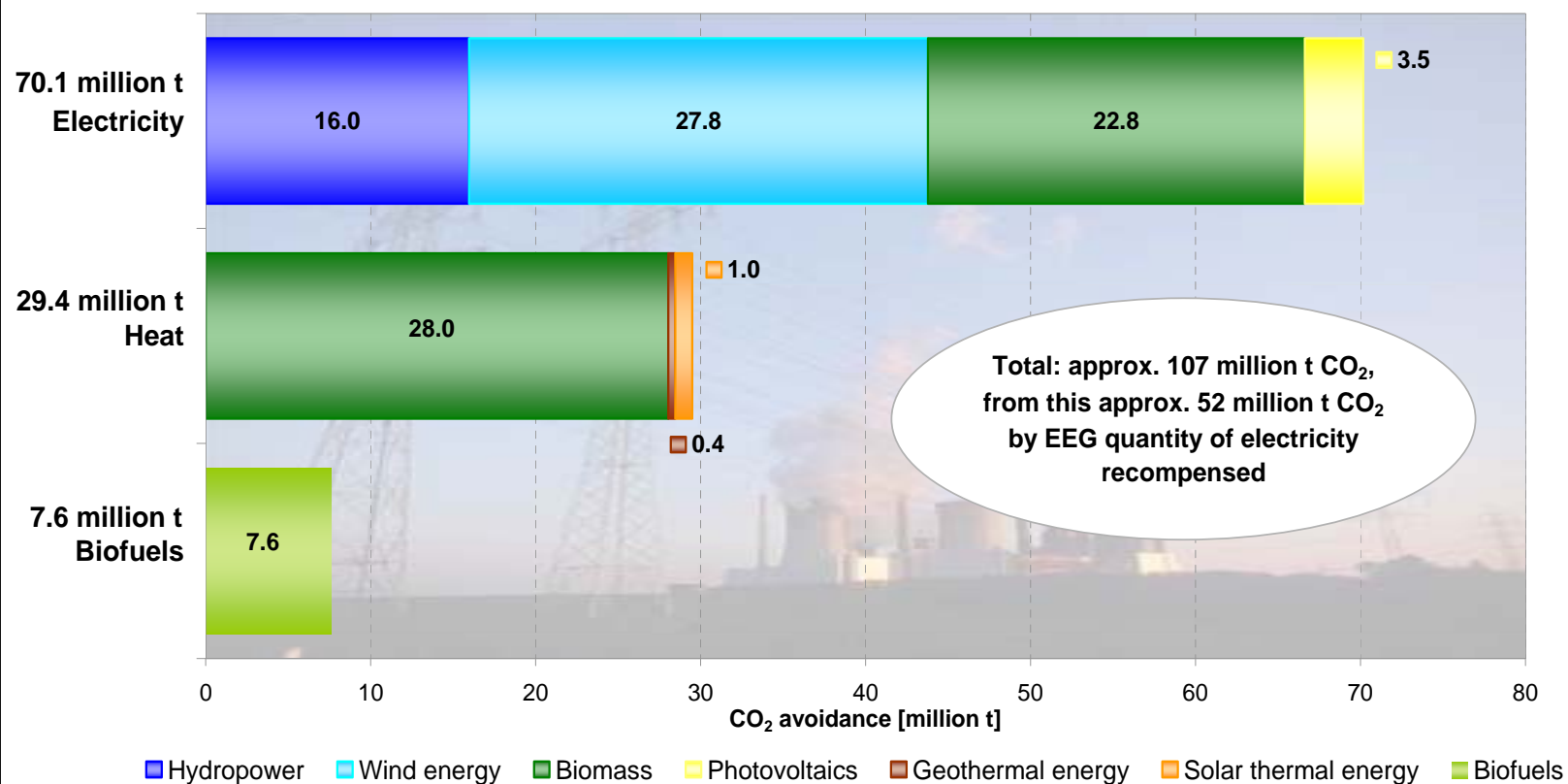


* Solid, liquid, gaseous biomass, biogenic share of waste, landfill and sewage gas; Deviations in the totals are due to rounding;
Source: BMU-KI III 1 according to Working Group on Renewable Energies-Statistics (AGEE-Stat); all figures provisional



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Total CO₂ avoidance via the use of renewable energy sources in Germany 2009

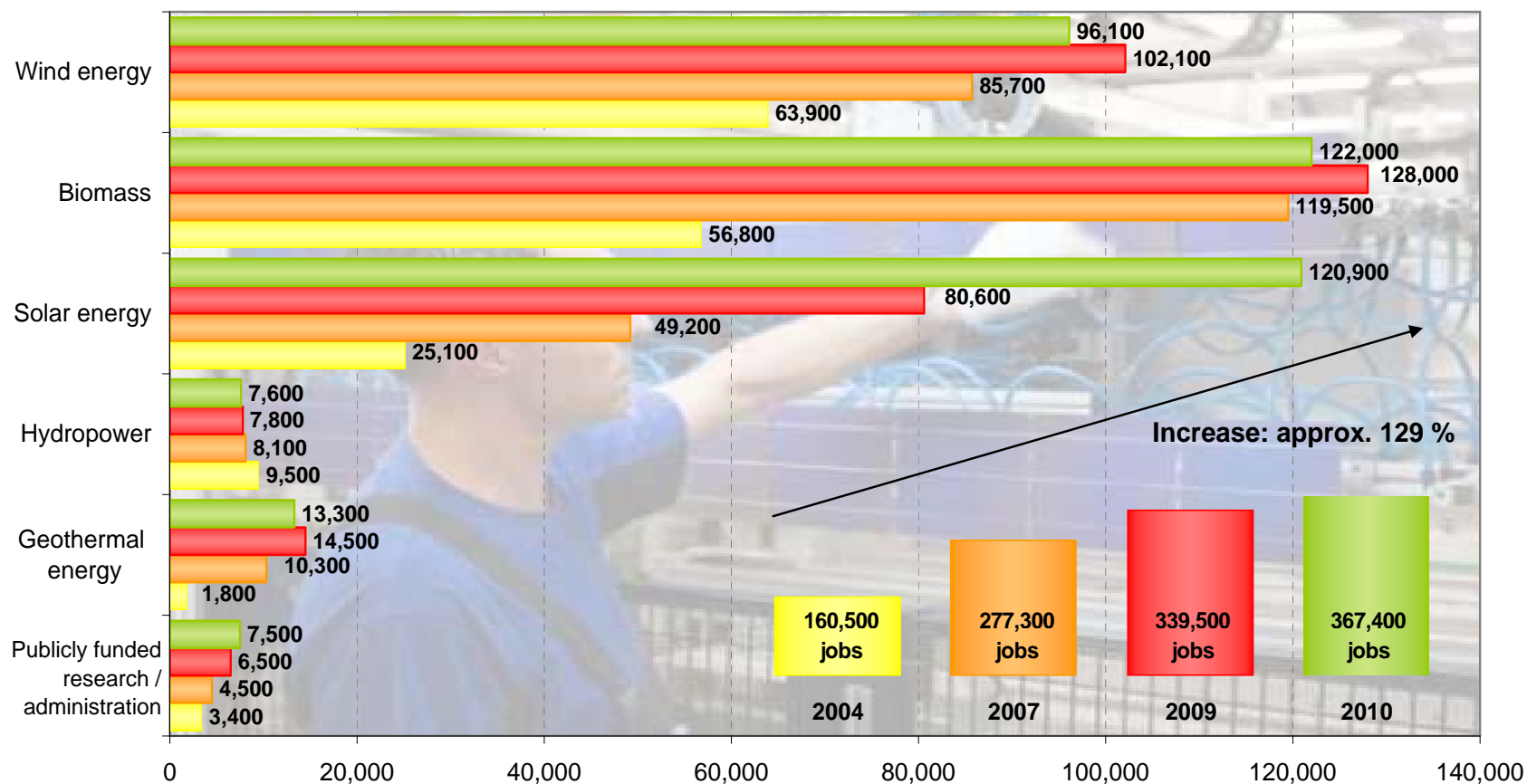


EEG: Renewable Energy Sources Act; Deviations in the totals are due to rounding;
Source: UBA according to Working Group on Renewable Energies-Statistics (AGEE-Stat); Image: H. G. Oed; all figures provisional



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Jobs in the renewable energy sources sector in Germany



Figures for 2009 and 2010 are provisional estimate; deviations in totals are due to rounding;

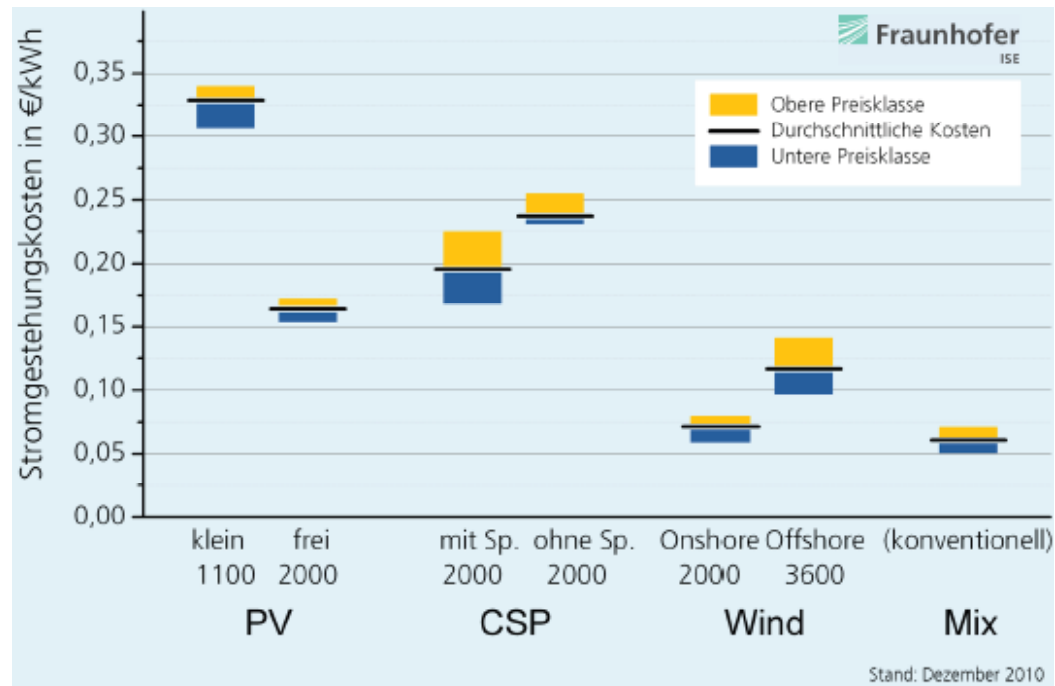
Source: O'Sullivan/Edler/van Mark/Nieder/Lehr: "Bruttobeschäftigung durch erneuerbare Energien im Jahr 2010 – eine erste Abschätzung", as at: March 2011; interim report of research project „Kurz- und langfristige Auswirkungen des Ausbaus erneuerbarer Energien auf den deutschen Arbeitsmarkt“; image: BMU / Christoph Busse / transit



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2.5 Electricity production costs in 2010



Source: Fraunhofer Institute for Solar Energy Systems ISE

The electricity production costs of all renewable energies decrease:

- Technological innovations,
- Reduced material usage,
- More efficient production processes,
- Increase of efficiency factor
- ever-increasing mass production



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3. Rhineland-Palatinate



100% power supply from renewable energies 2030 (2009 = 30%)
Reduction of CO2 emissions by 2050 relative to 1990 by 90%

- Windenergy: 43% of RES 2007
- 1,125 wind turbines 2011
- Windenergy increase fivefold to 2020
- PV: 2011: installed capacity 912 MWpeak
- PV: 2020: increase power generation to 2 TWh
- Biogas: 98 plants 2009
- Biomass: currently approx. 300 plants



**Decentralized electricity supply
will promote regional value creation**



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4. Regional context

4.1 Advantages for the municipalities

- Solar energy is free
- Produces **no noise or harmful emissions**
- High public acceptance
- Minimal maintenance required to keep the system running
- Modular systems can be quickly installed and easily expanded, Safety and reliability are proven
- Climate protection
- Image improvement
- Create local jobs
- New perspectives for the rural areas
- **Financial income (Feed-In Tariff, tax), regional value creation**

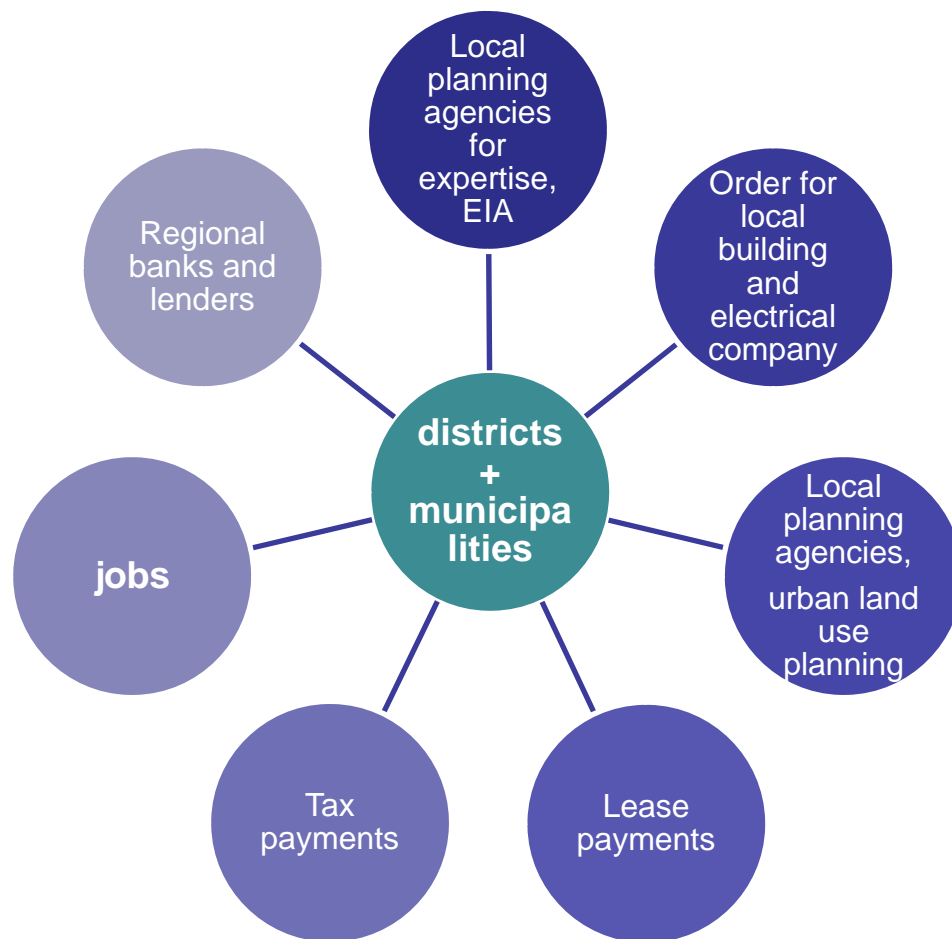




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How can districts and municipalities benefit from renewable energies?



Results from the Rhein-Hunsrück-District in 2009

Regional value creation from Renewable Energies:

- Total local value creation: **€8.3 million**
- With additional leasing income: **€9.4 million**
- **Electricity: €7.5 million** **Wind turbines: €3.7 million**
Photovoltaic systems: €3.1 million
- **Heat: €0.5 million**
- **Biofuels: €0.3 million**
- **Municipal tax revenues: €0.6 million**
- **Lease revenue: €1.2 million**
- **Saving of fossil fuel imports: €12.3 million**
- **CO2 savings: 269,103 tons**
- **86 full time employees**





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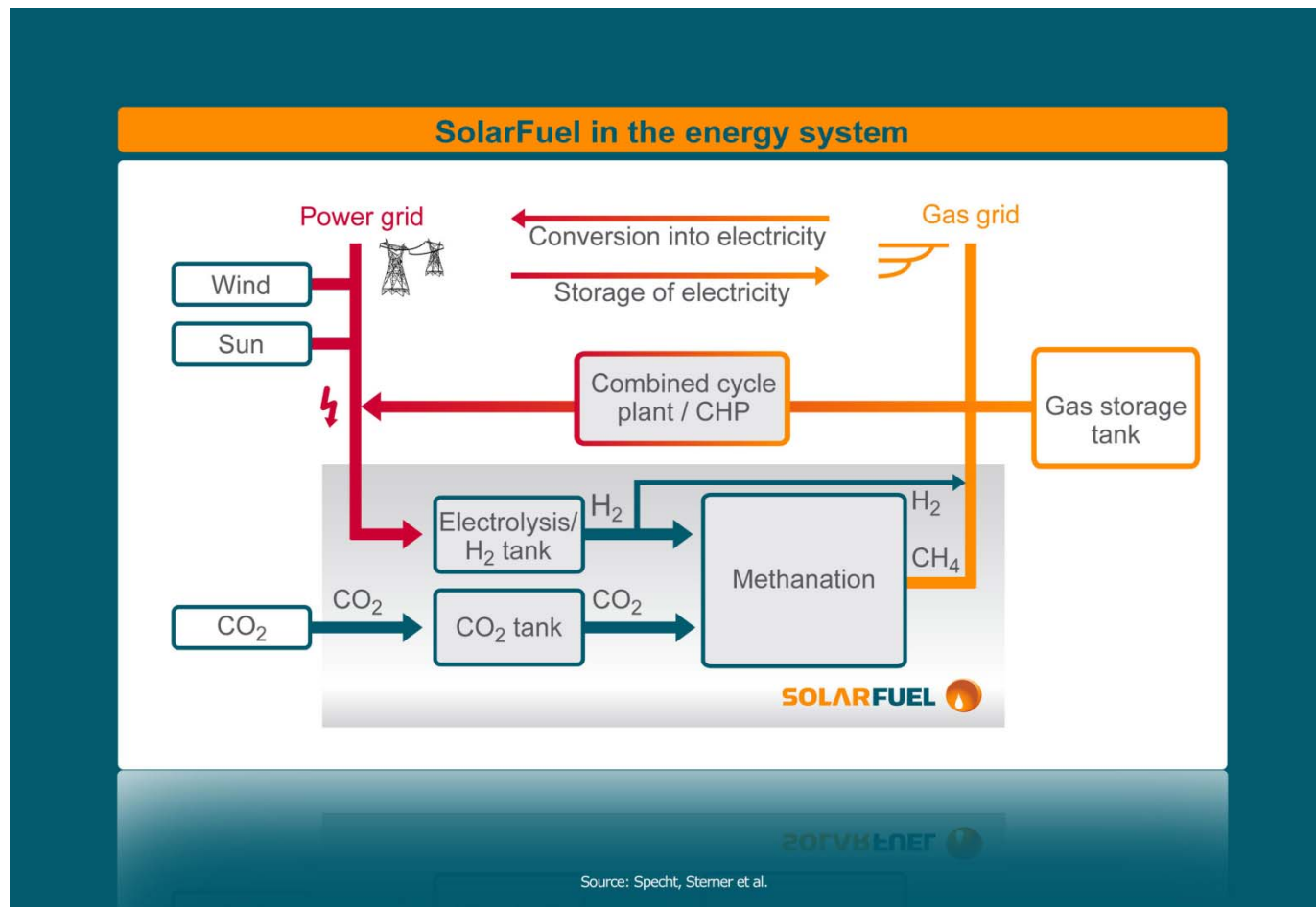
Merci pour votre attention.
Thank you for your attention.

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5. Outlook, future technology





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Power-to-gas

The power-to-gas method **converts green electricity into CO2 neutral, renewable natural gas.**

Advantages:

- The **accommodation of larger shares of renewable electricity** in the energy system is possible.
- Renewable natural gas **stores the electricity for long periods of time** and can be accessed at all times for
 - **Power generation**
 - **Heat production**
 - **Mobility as fuel in cars**
- The natural gas infrastructure with its large-scale capacities can keep energy in storage for several months.
- **In this way, the existing natural gas network becomes a cornerstone for the renewable energy system, and provides the storage and transport capacities which are not available in the power grid.**