

Status of the Energy Transition of Germany

**Friedrich-Ebert-Stiftung (FES) / Energia Klub Workshop
» Options for Sustainable Alternatives of Nuclear Energy in Hungary «**

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- **German population 81 million**
- **German GDP in 2,736 bn € (3,633 bn US\$) in 2013**
 - Highly industrialized (26% of GDP from industry)
 - Strong manufacturing industry
 - Strong primary industries (2013: Crude steel production 43 mln t, Primary aluminum production 492,000 t)
 - Strong net exporter (net trade surplus in 2013: ~ 195 bn €)
- **Primary energy (2013): Oil 34%, natural gas (23%), hard coal (13%), lignite (12%), renewables (10%) , nuclear (8%)**
- **Power generation (2013): lignite (25%), renewables (24%), hard coal (19%), nuclear (15%), natural gas (11%), others (5%)**
- **Strong federal structures (significant impact of states on energy legislation), strong municipalities (~900 municipal utilities)**
- **Member of the European Union (internal market, increasing integration of energy and climate policies)**

- **The German Energiewende policy is not about the time to 2020**
 - The double u-turn on nuclear phase out was surprising, not the phase-out decision
 - agreement on nuclear phase-out trajectory in 2000, since 2002 in the legislation
 - 2011 phase-out decision (after the 2010 NPP lifetime extension) was essentially a return to the 2002 legislation
 - The roll-out of renewables by 2020 is based on legally binding obligations under the 2009 EU Renewables Directive
 - Thought experiment: ignoring the 2010/2011 decisions, today's situation would approximately be the same
- **The essential innovation of the 2010/2011 energy policy decisions is the switch to a long-term perspective and long-term goals**
 - 80...95% greenhouse gas emissions reductions by 2050
 - 80% power generation from renewable energy sources by 2050
 - full nuclear phase-out by 2022

Background: German policy targets beyond the nuclear phase-out by 2022

	GHG emissions	Renewable Energies		Energy efficiency				Nuclear power
		Gross final consumption	Power generation	Primary energy	Space heating	Final Energy	Power consumption	
2011								-41%
2015								-47%
2017								-54%
2019								-60%
2020	-40%	18%	35%	-20%	-20%	-10%	-10%	
2021								-80%
2022								-100%
2030	-55%	30%	50%					
2040	-70%	45%	65%					
2050	-80 to -95%	60%	80%	-50%	-80%	-40%	-25%	
Base year	1990			2008	2008	2005	2008	2010

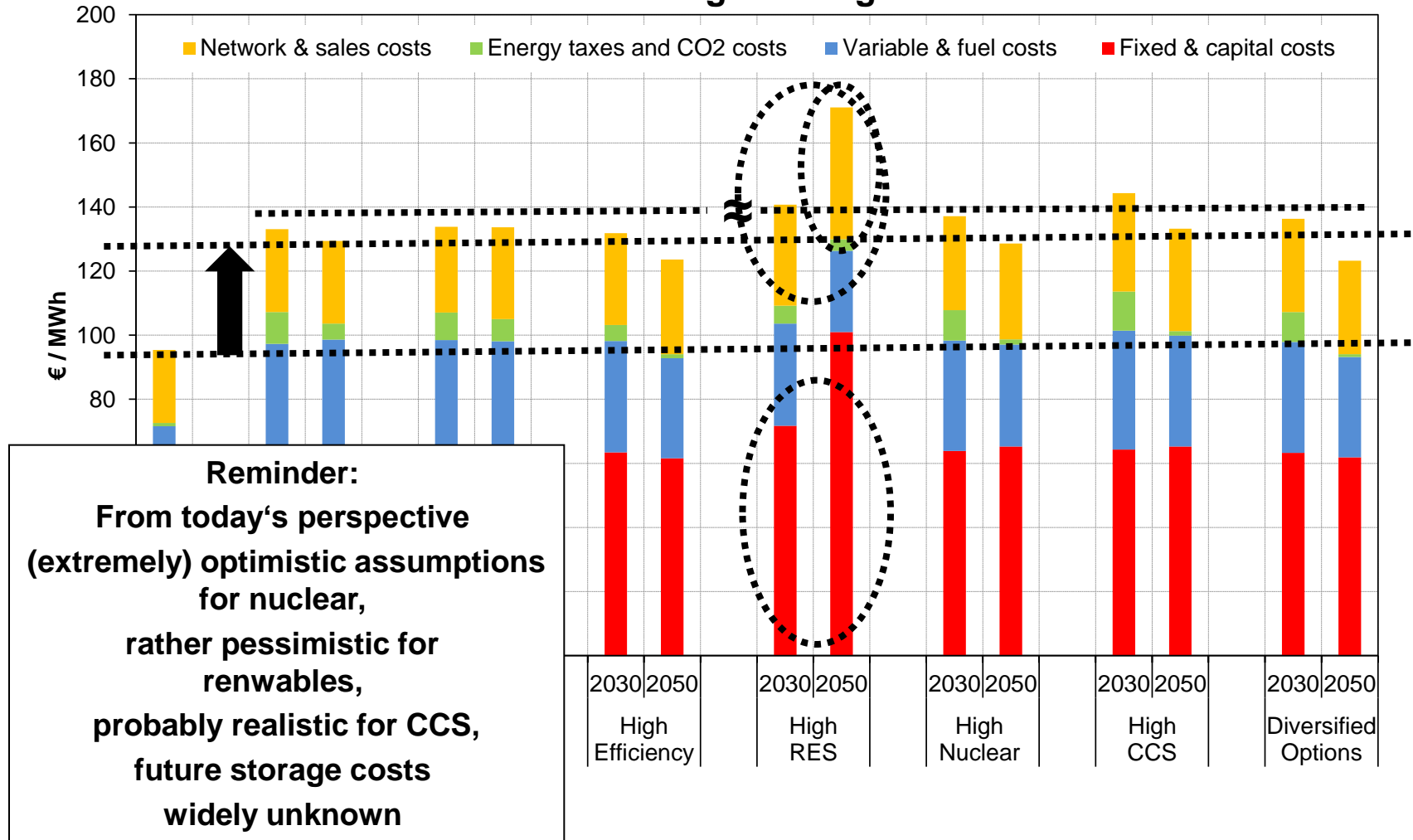
- **Emerging investment needs in Germany – and most other European countries/regions**
 - after two decades of under-investments (50% of historical levels)
 - in an era of very different price trends
 - increasing costs of conventional technologies and infrastructures (+70% in the last decade),
 - significantly decreasing costs of renewables (-20% onshore wind, -90% solar PV, cost decreases still to come for offshore wind)
 - high uncertainties in the global fuel markets (hard coal, gas , impact of shale gas?, etc.)
 - in the framework of ambitious greenhouse gas emission reduction (and renewables) targets – but a deep EU ETS crisis
 - after variable renewables shape the electricity market in many regions and this trend is beyond the point of no return
- **Energiewende is important, but not everything is Energiewende – Energiewende is also a response to more generic challenges**

- **Decarbonization of the energy sector as essential element of ambitious long-term greenhouse gas emission reduction targets: an EU-wide approach**
 - -80% emission reduction compared to 1990 levels
 - Key role of energy efficiency, renewable energies and other low-carbon options
- **Nuclear phase-out as a specific approach of energy transition – even beyond Germany**
 - Explicit phase-out decisions for Germany, Switzerland and Belgium
 - Explicit no-phase-in decisions for Italy, Austria and Denmark
 - Explicit decisions on a decreased role of nuclear for France (reduction of nuclear share to 50%)
 - Ongoing debates on the future role of nuclear power for Spain, The Netherlands; Sweden, Poland and the Czech Republic

The framework: EU power generation of the future

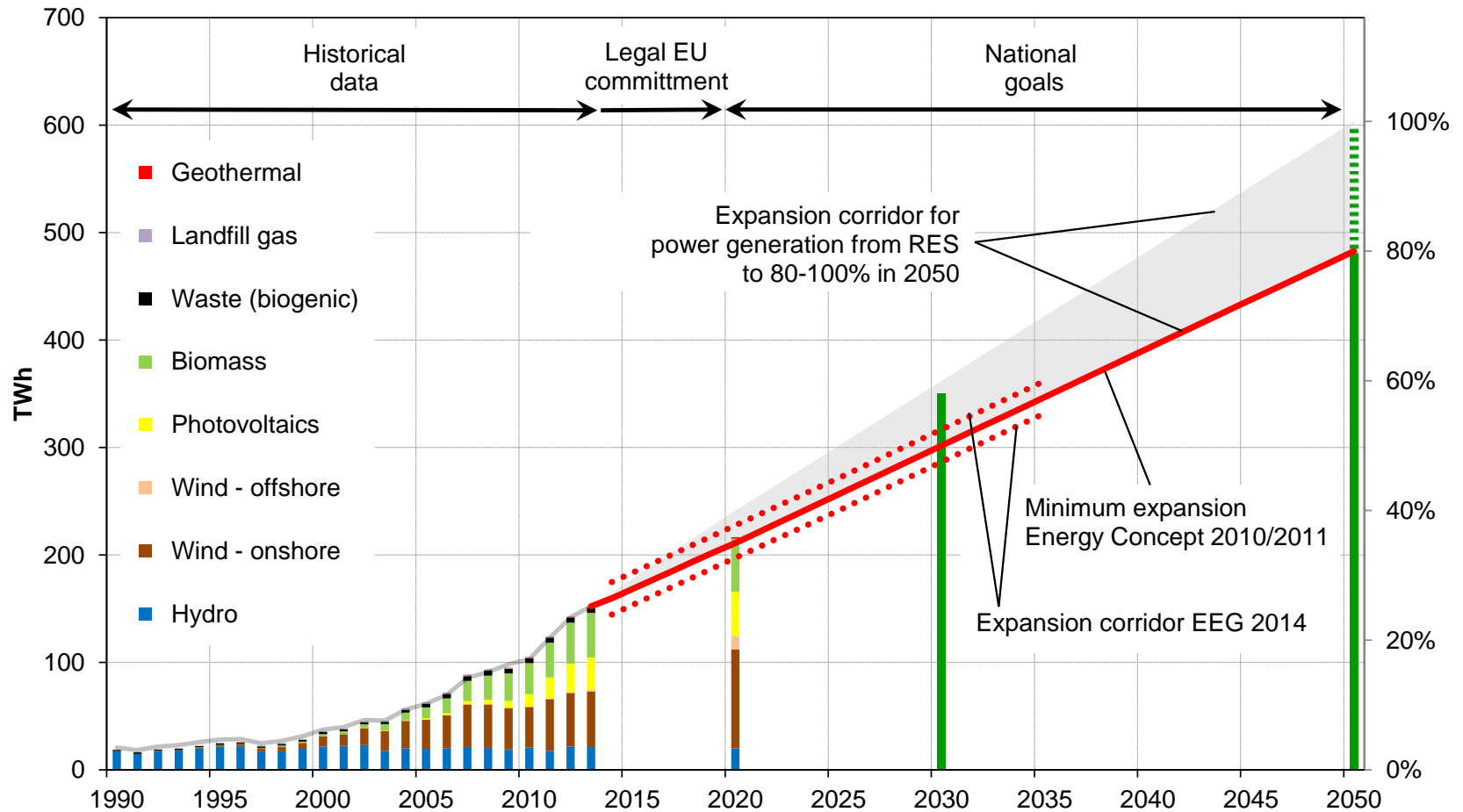
Significantly changing cost structures

1. higher system costs
2. (very) comparable system costs
3. capital-intensive
4. medium-term challenge: storage costs



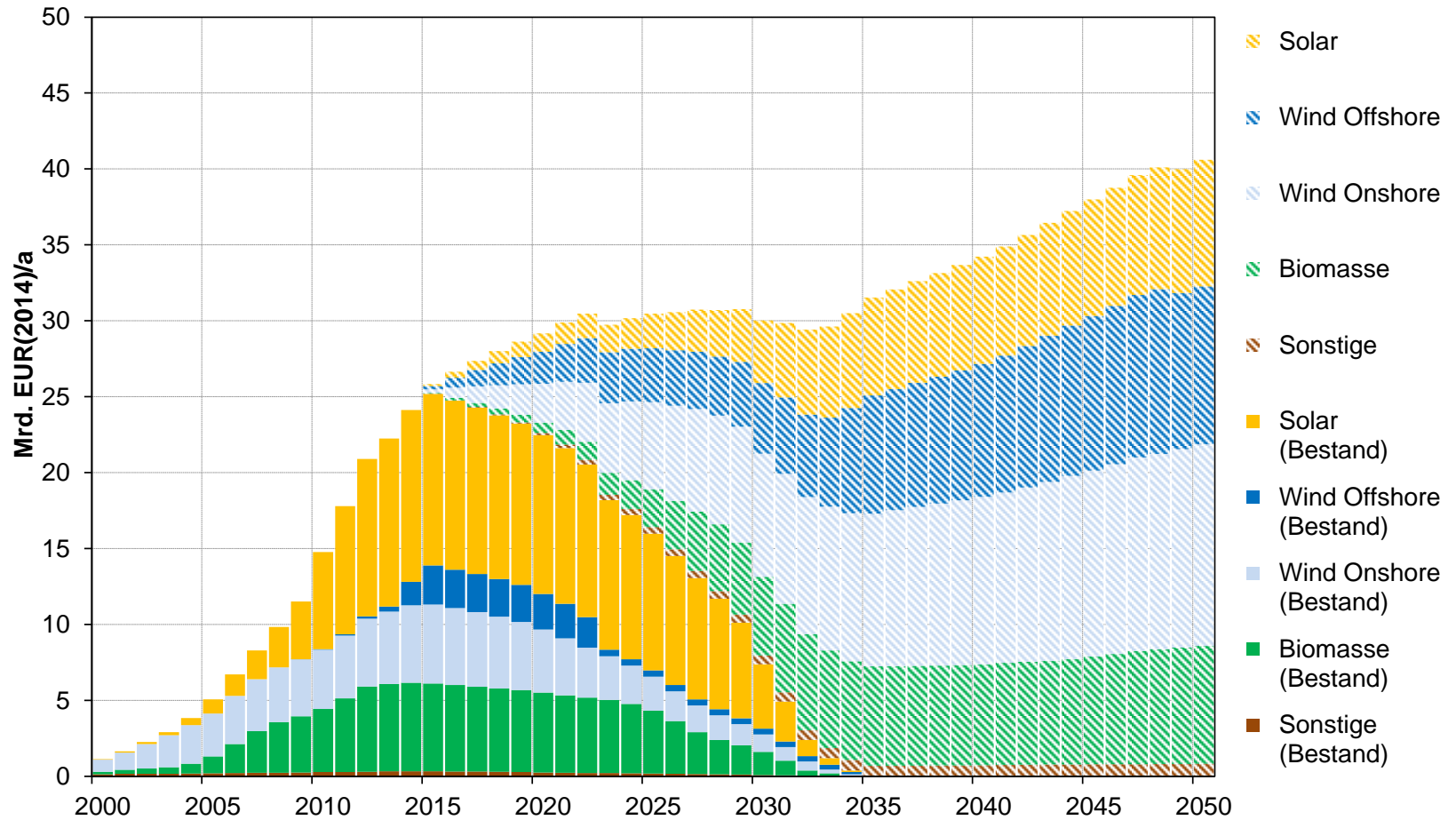
Energy transition in Germany

Expansion of power generation from renewables



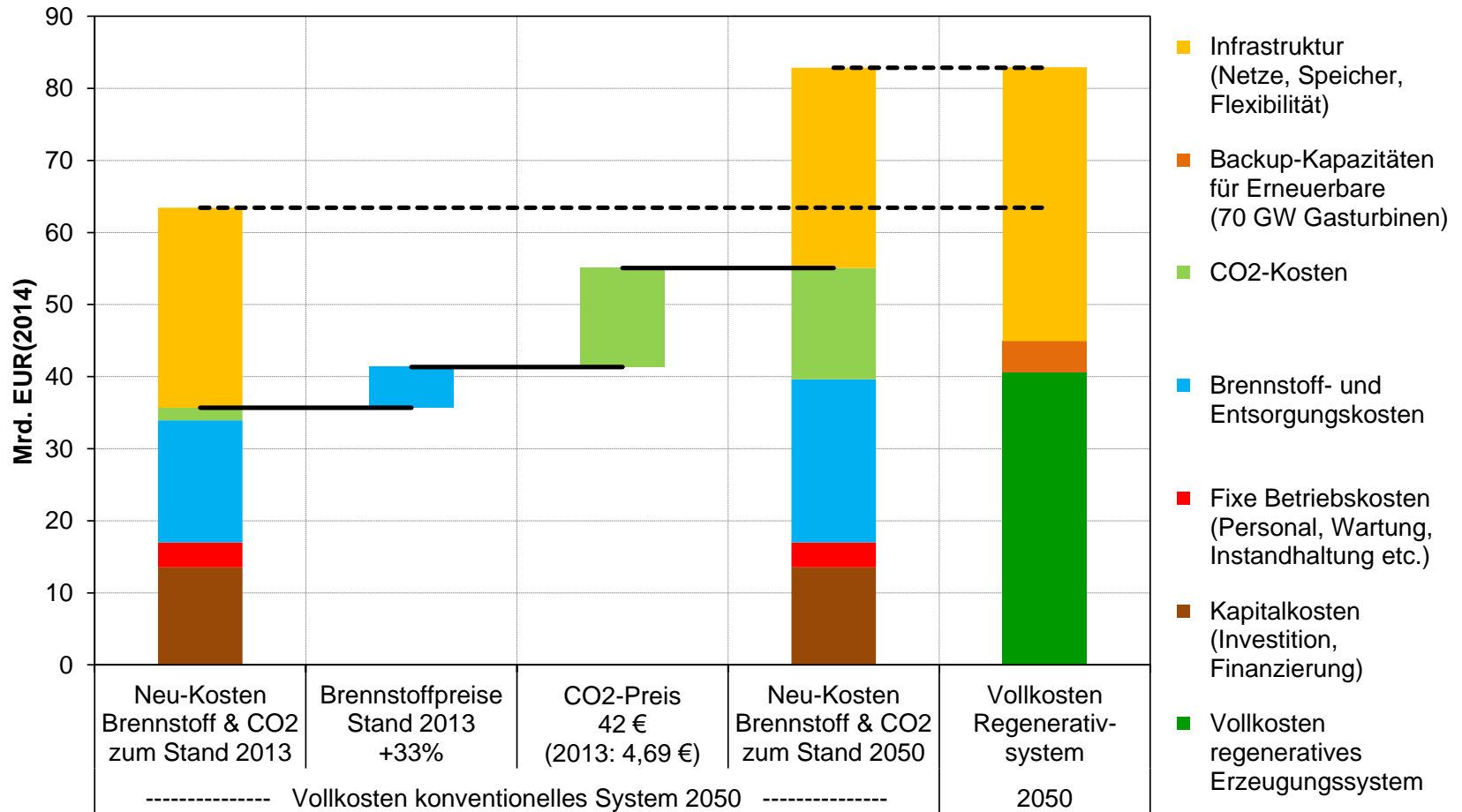
Long-term electricity policy of Germany

Total costs of RES power generation



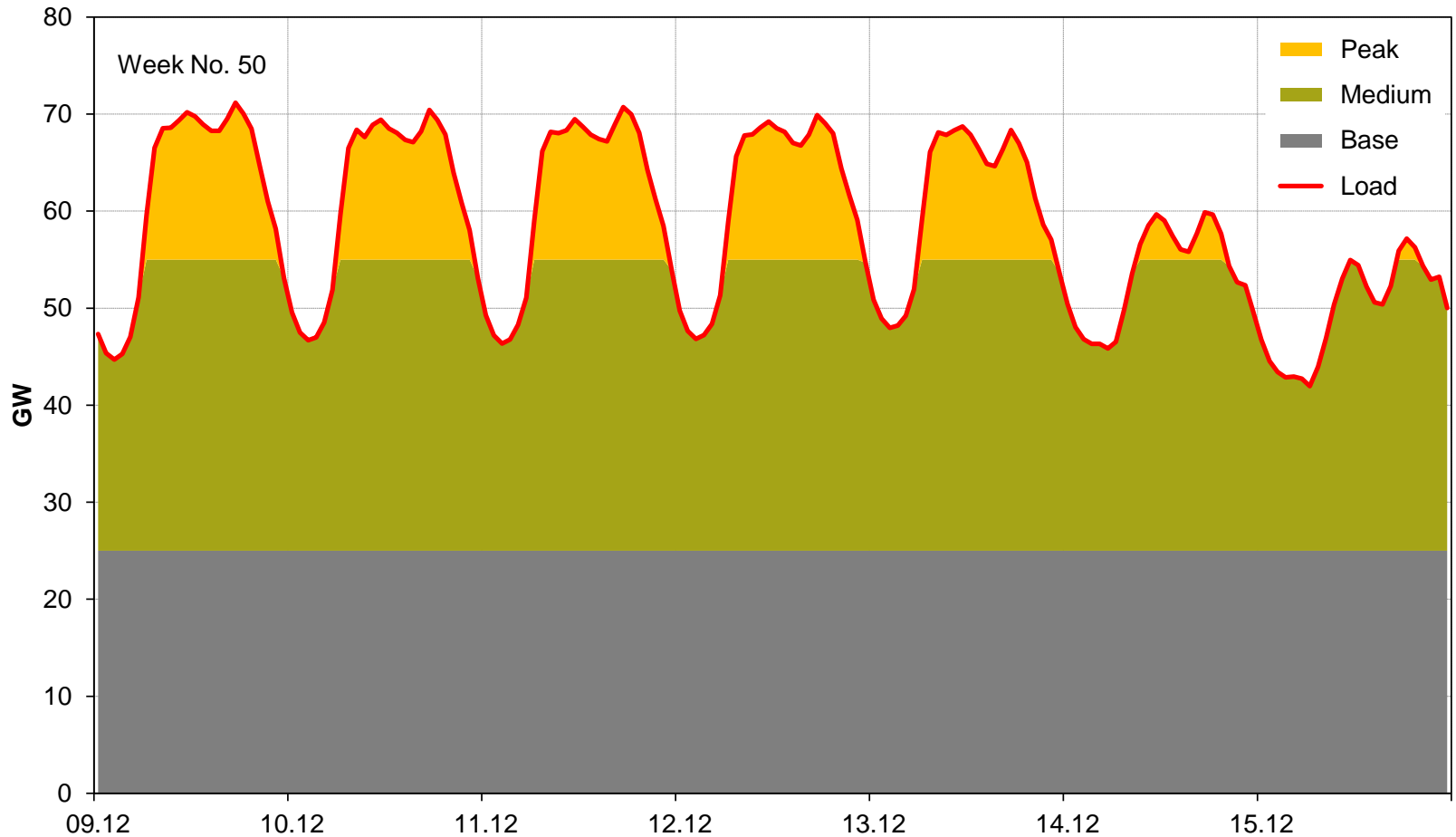
Long-term electricity policy of Germany

The past is not the counterfactual



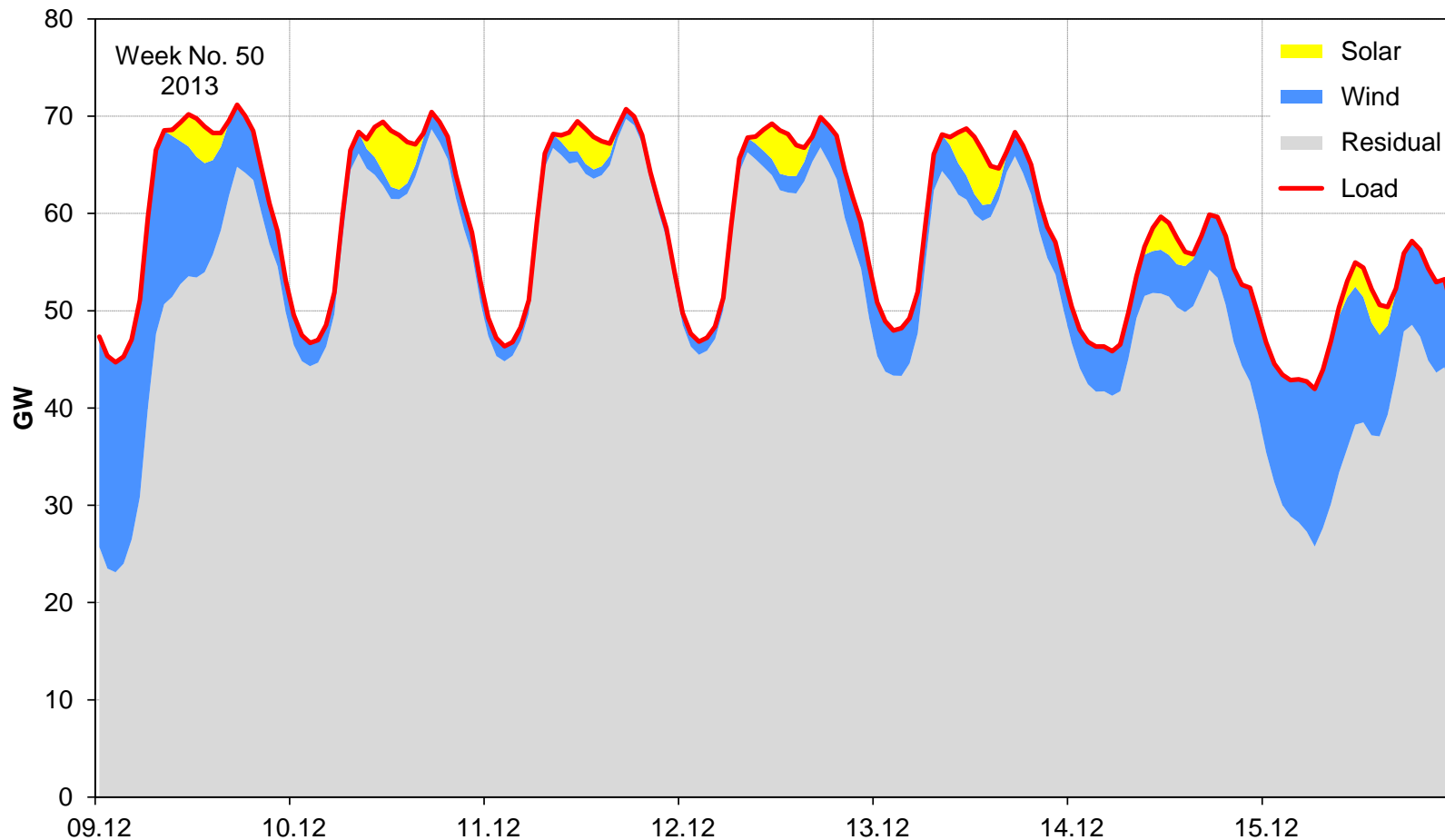
The traditional power market structures

A dark and cold week in Germany



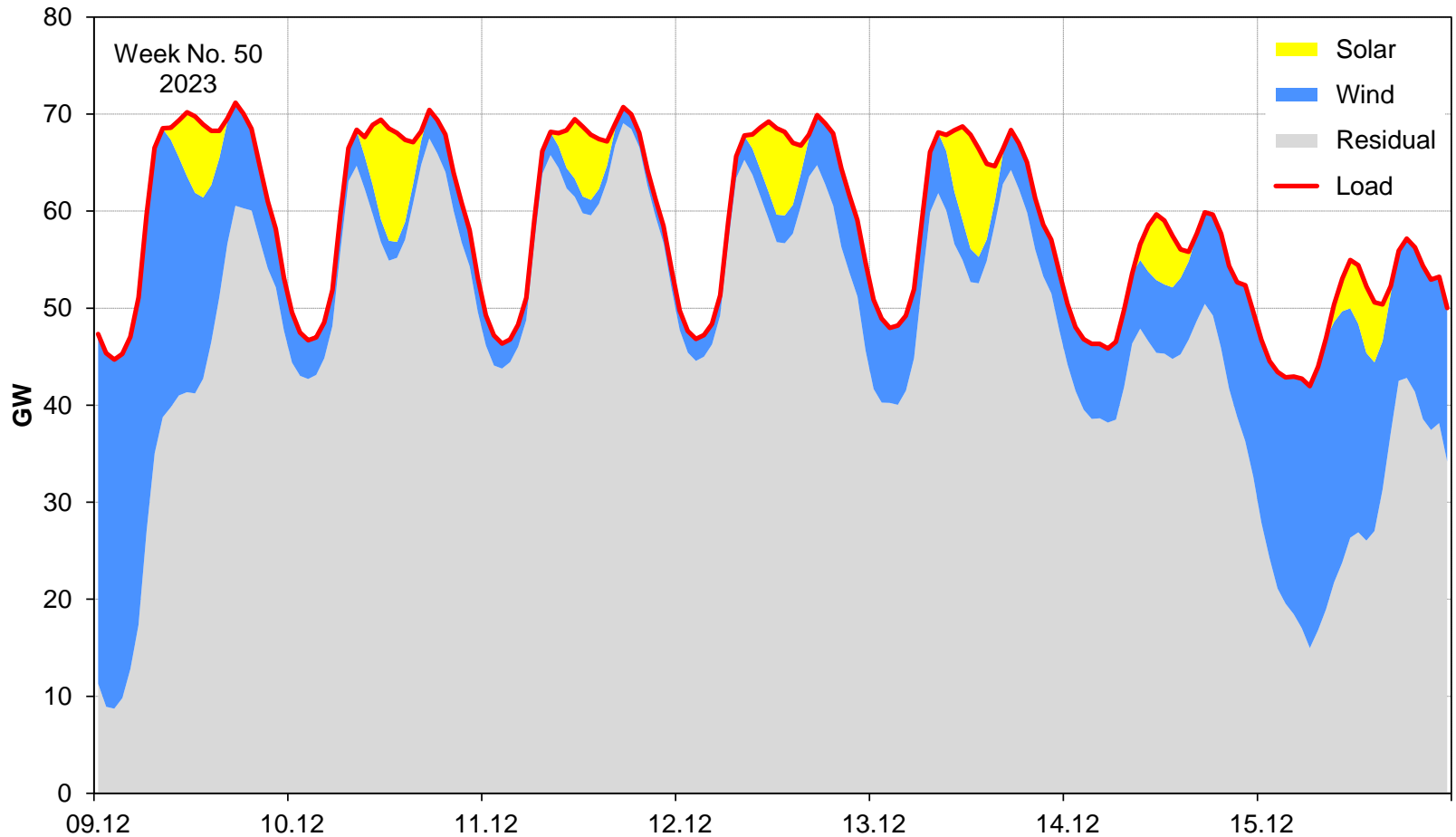
The new power market structures

A dark and cold week in Germany - 2013



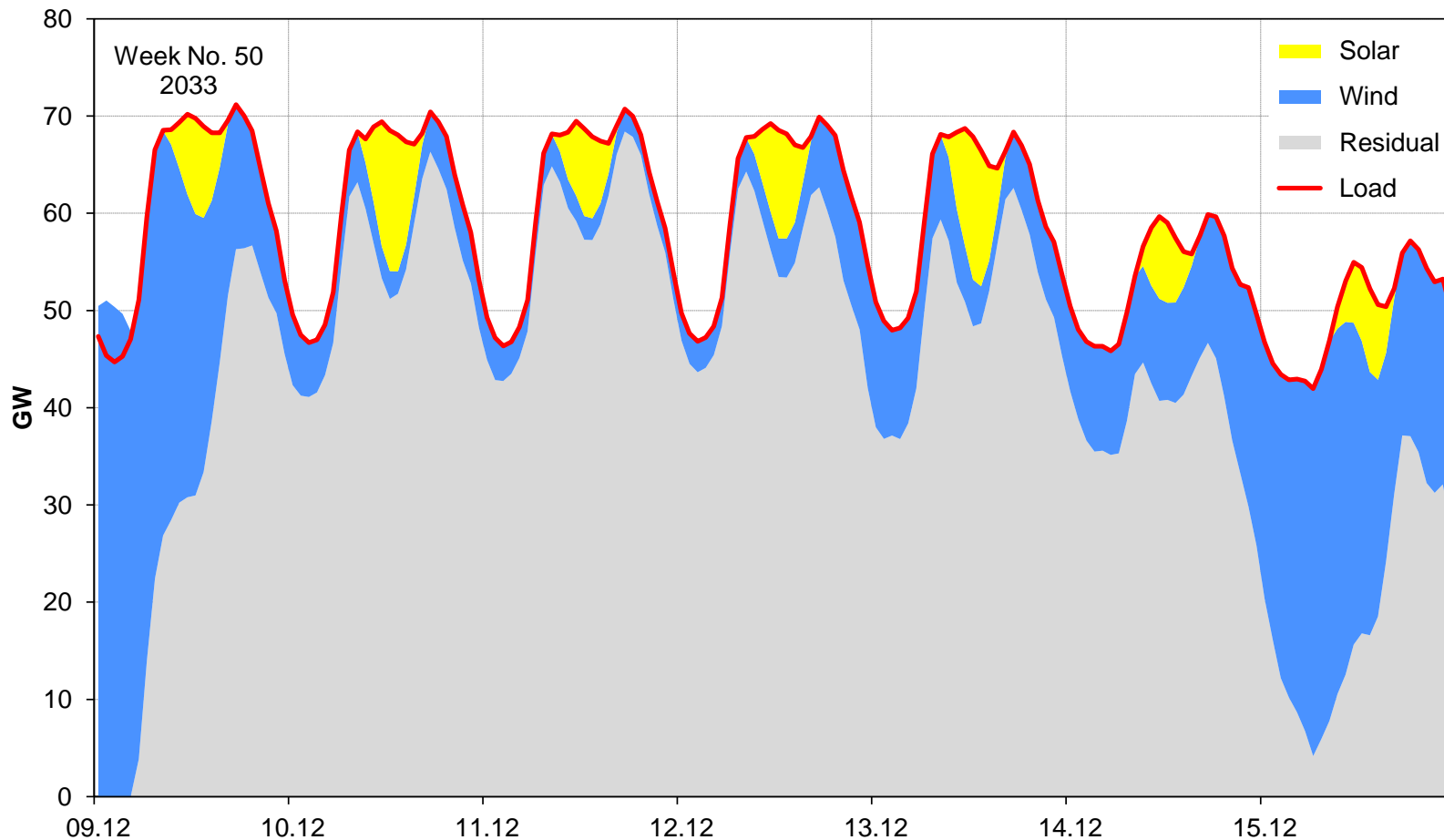
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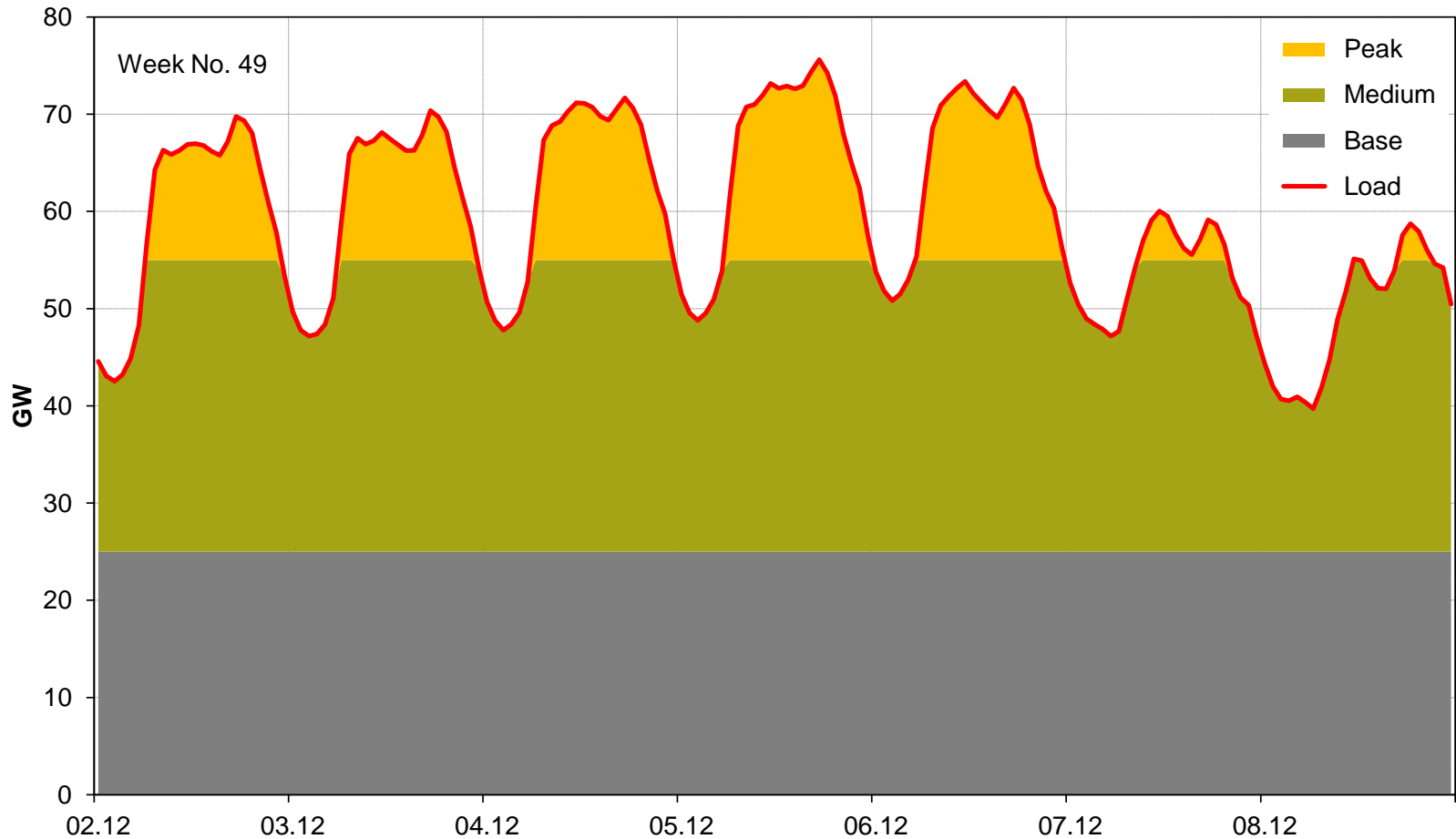
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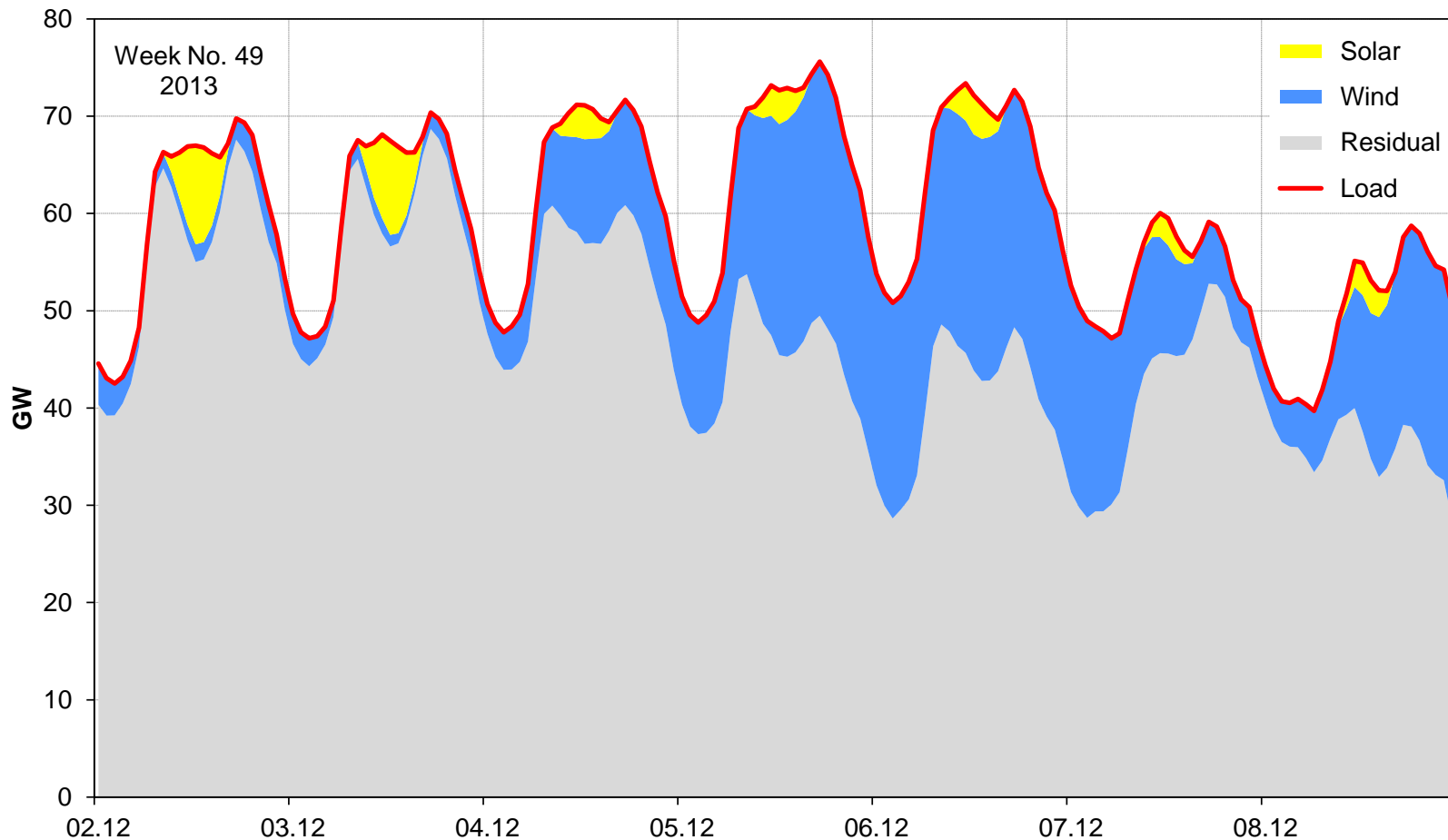
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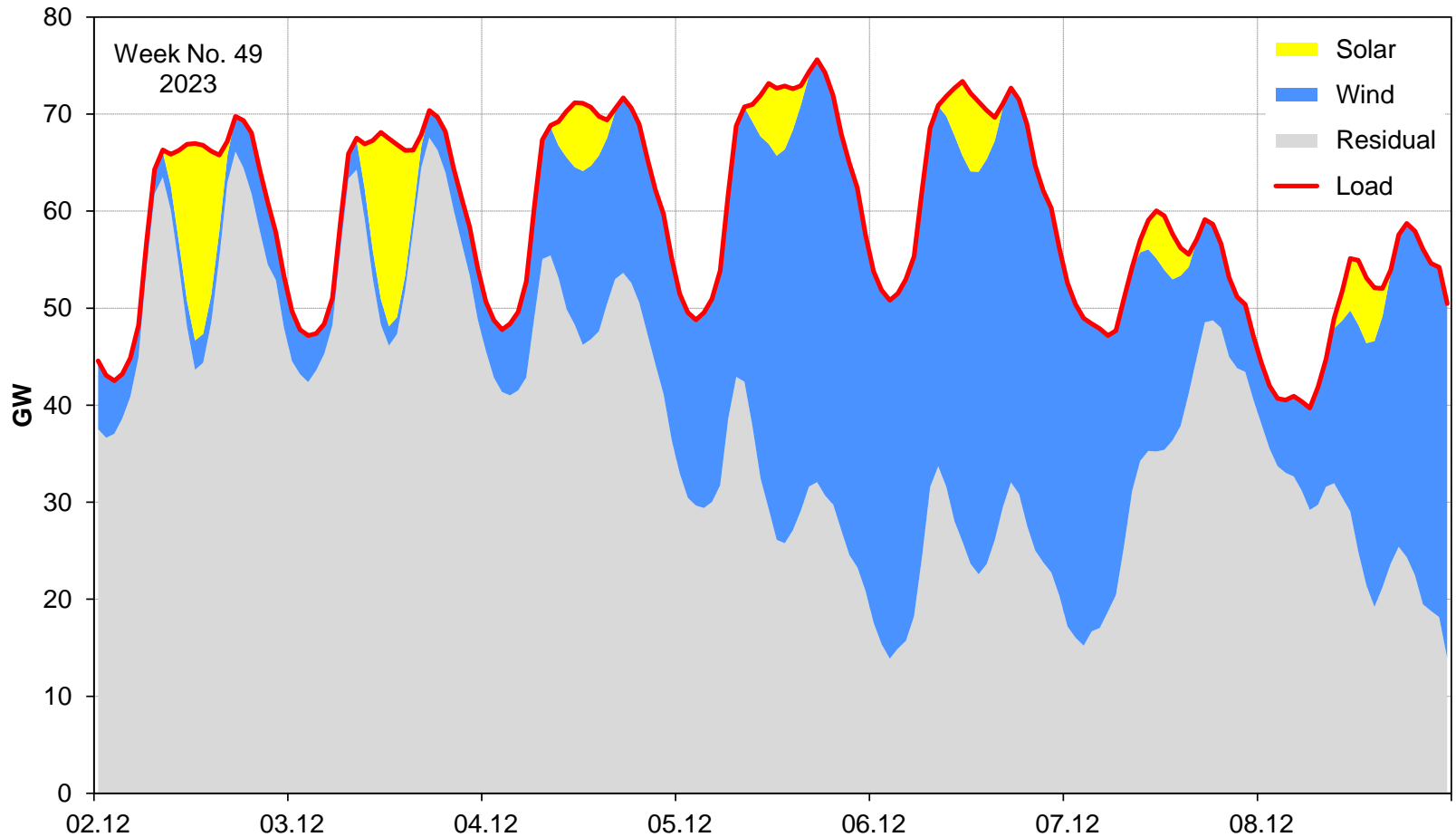
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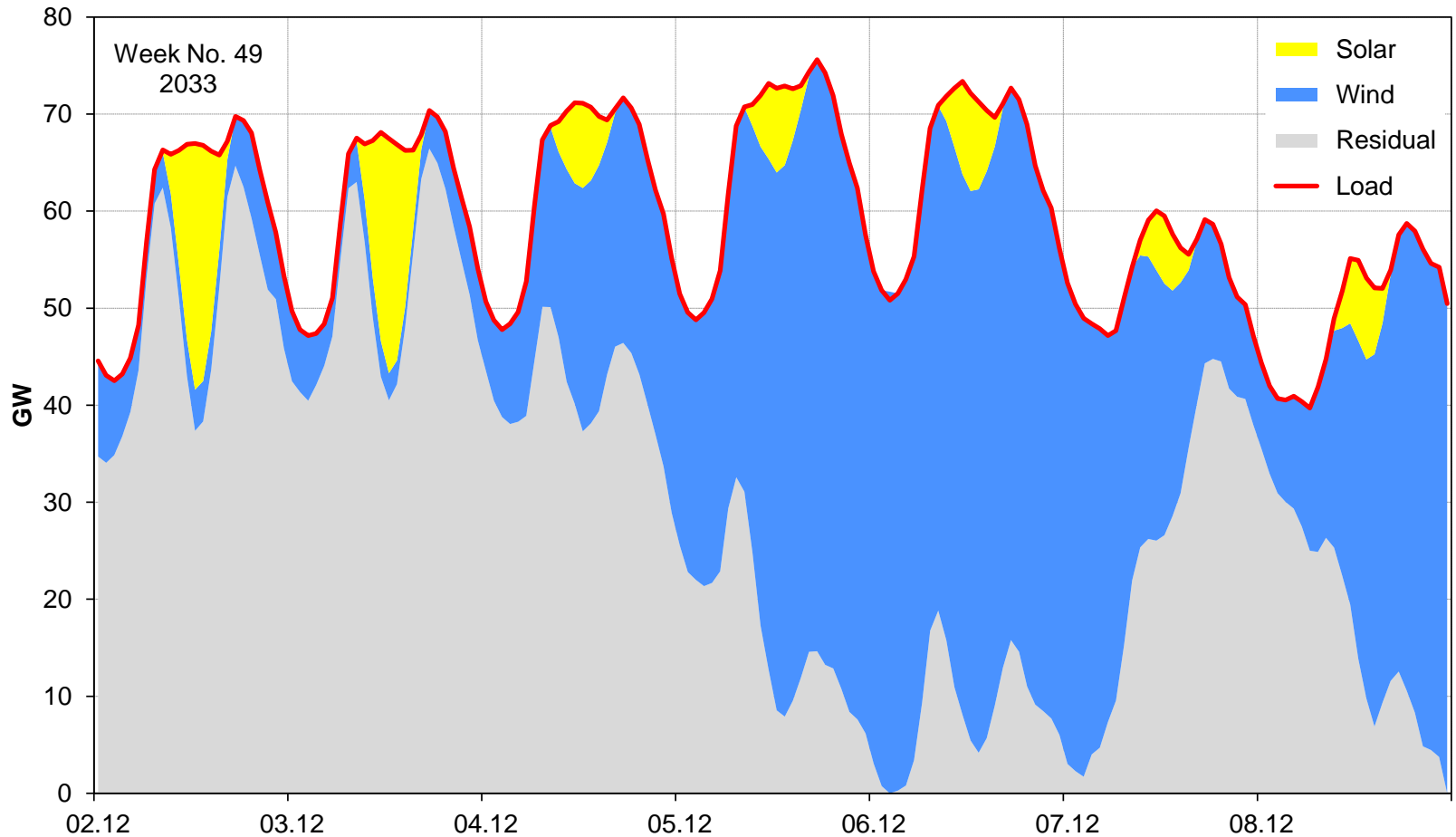
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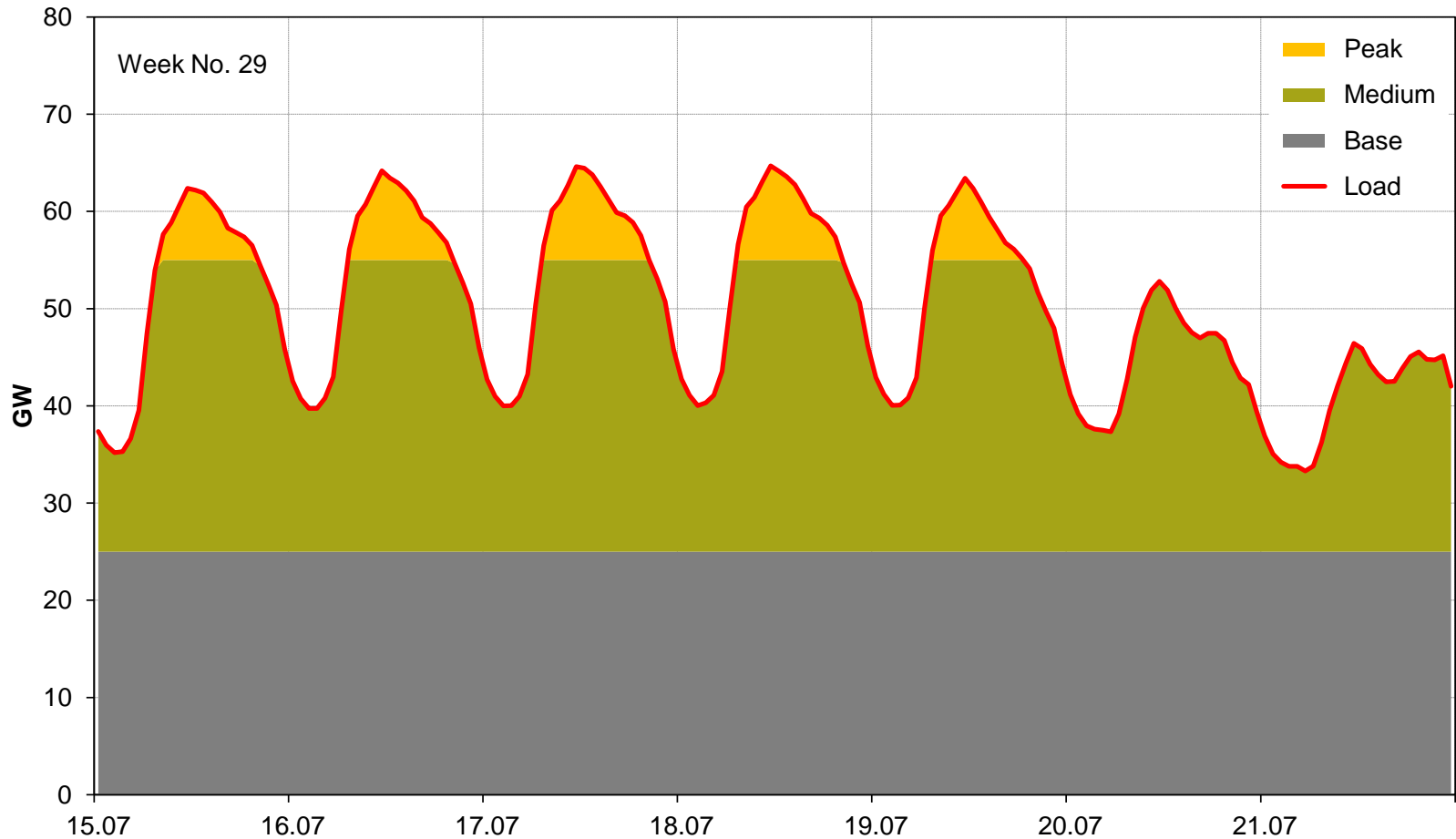
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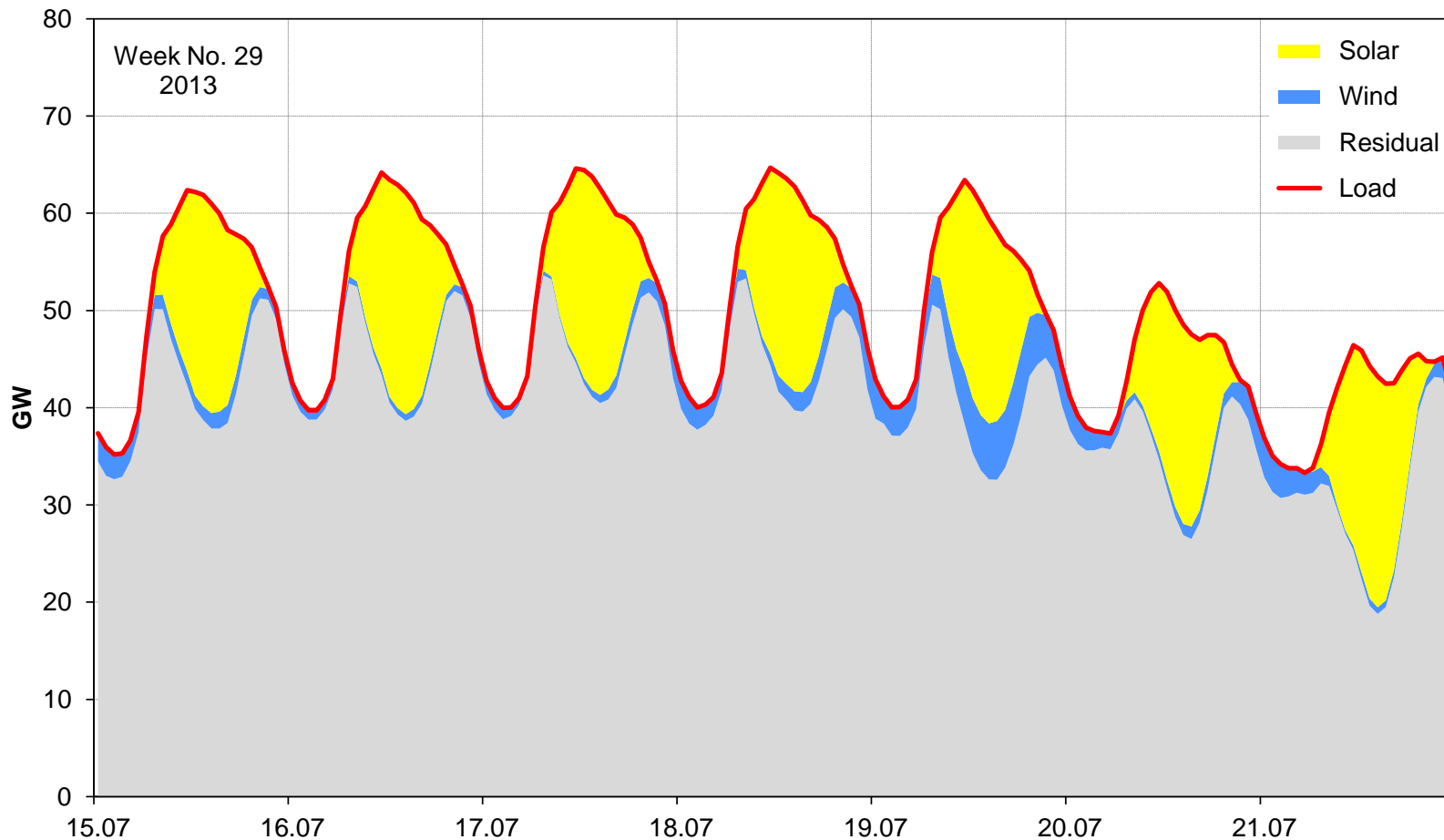
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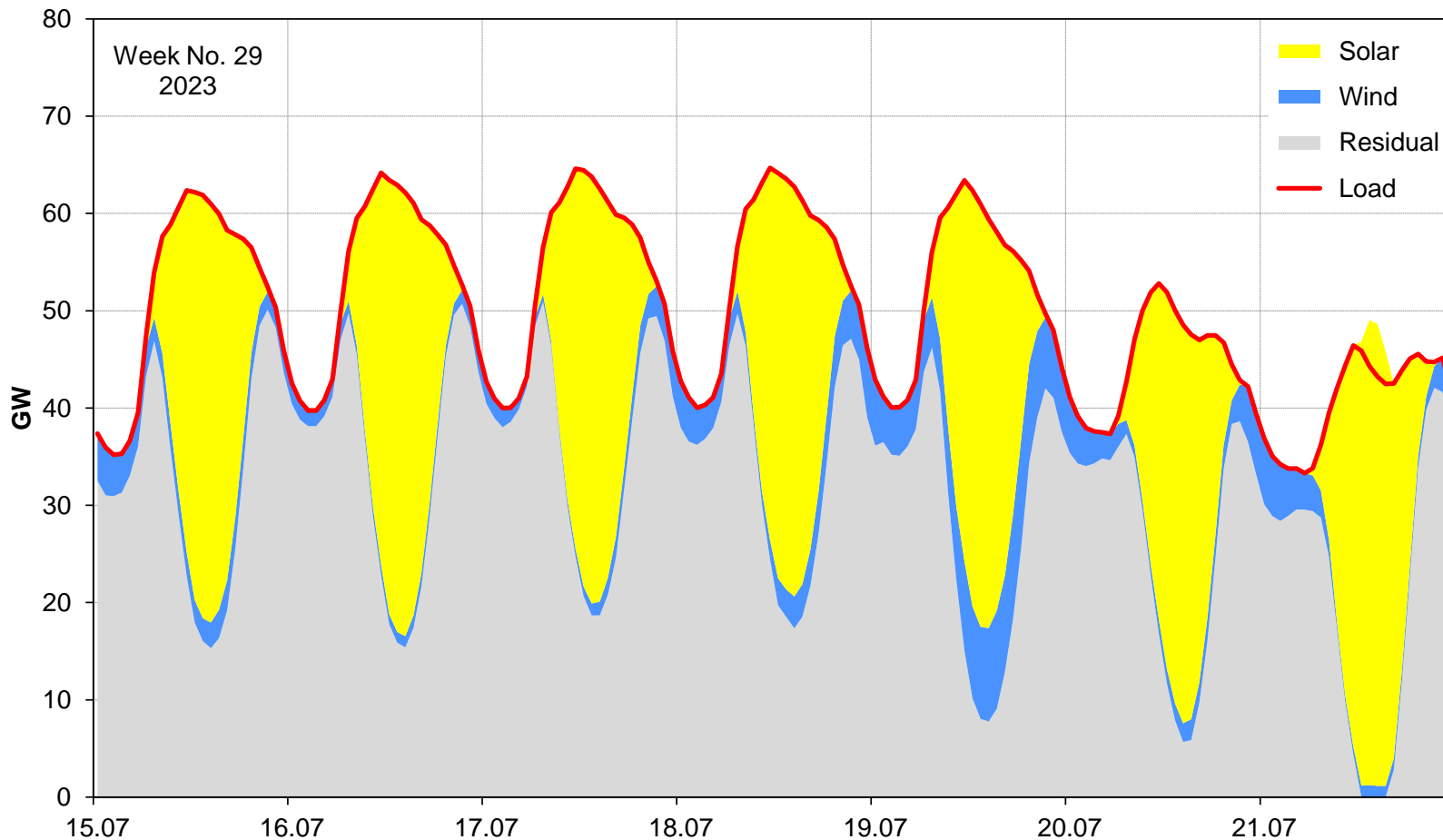
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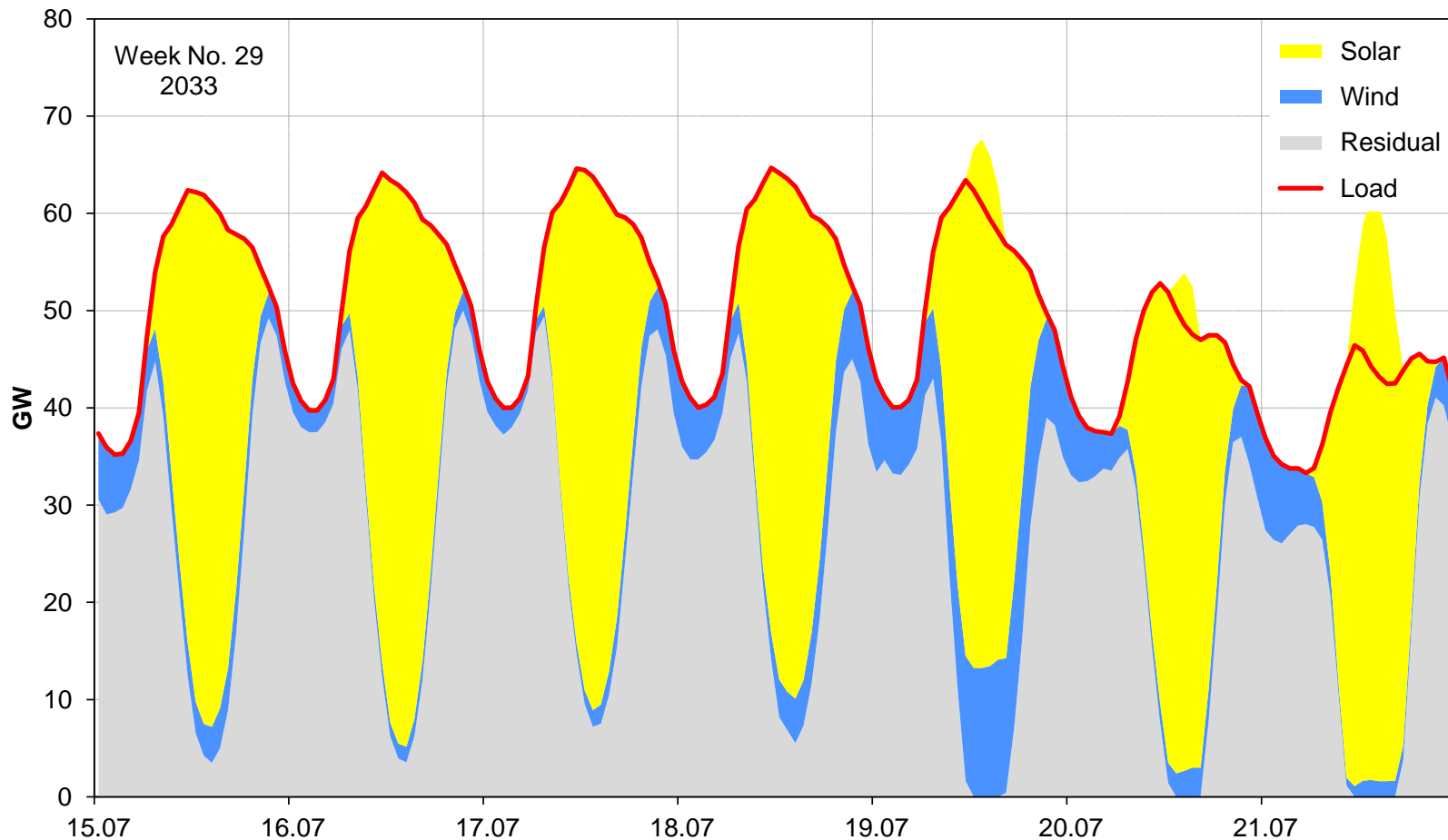
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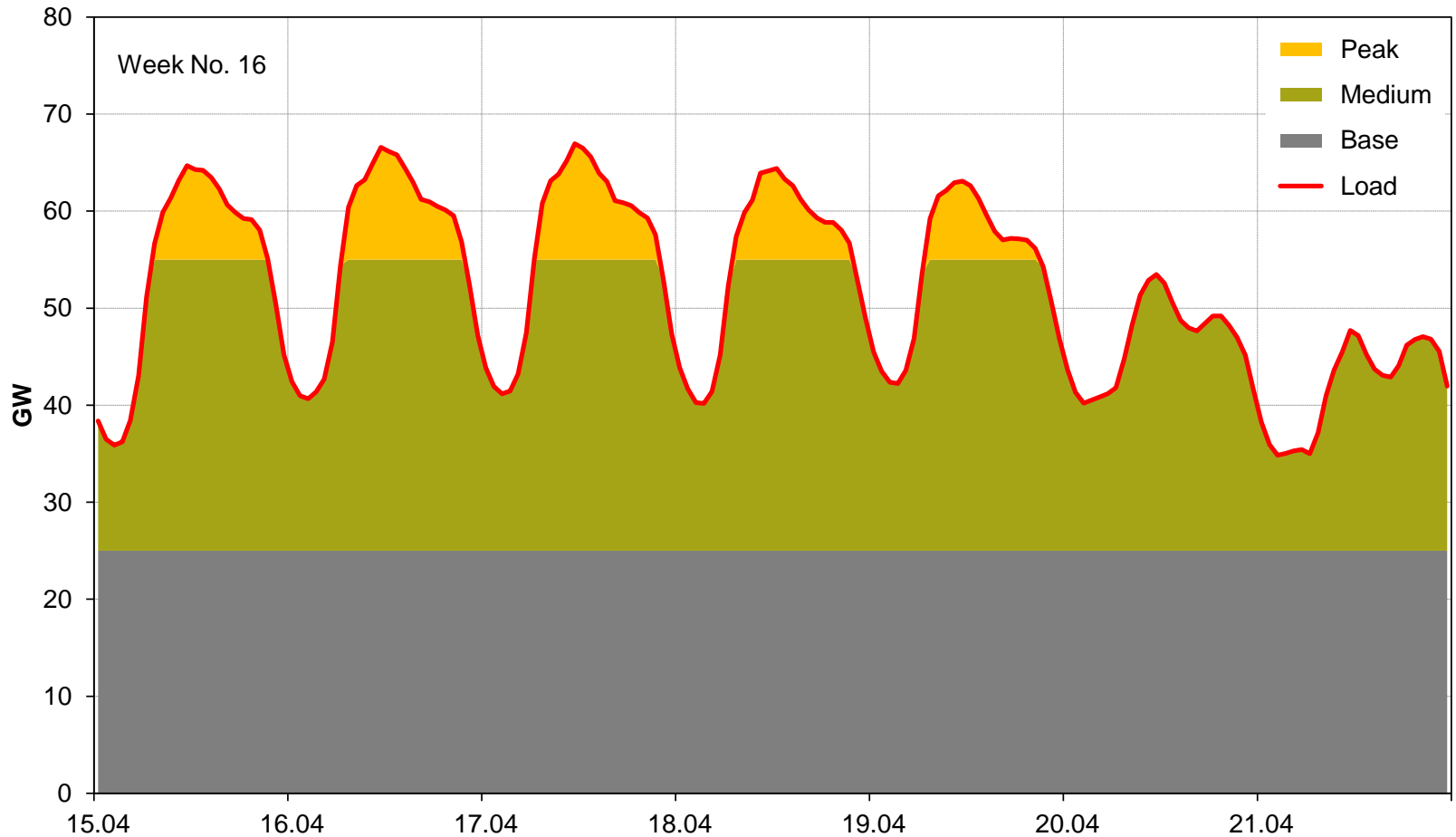
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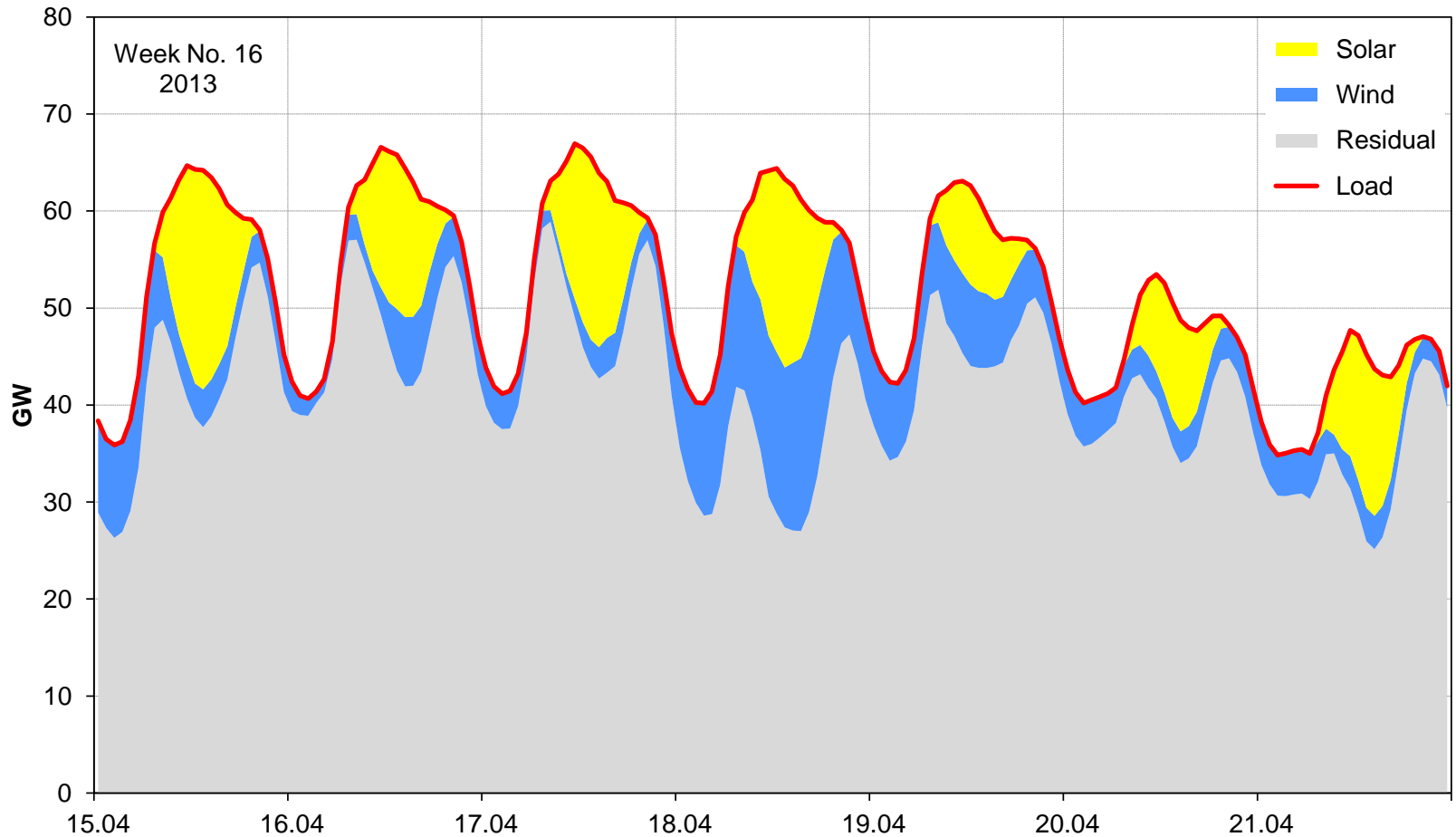
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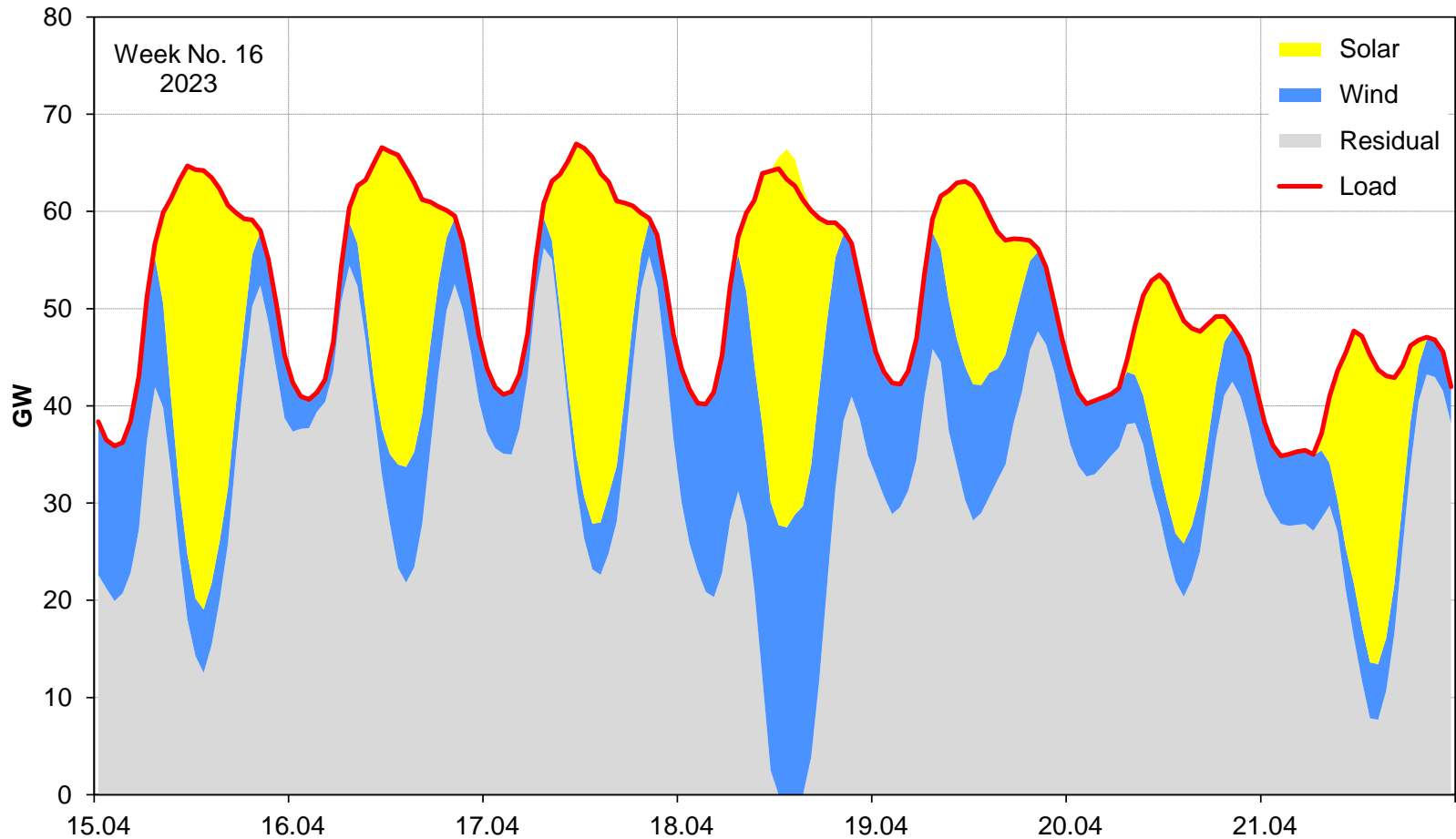
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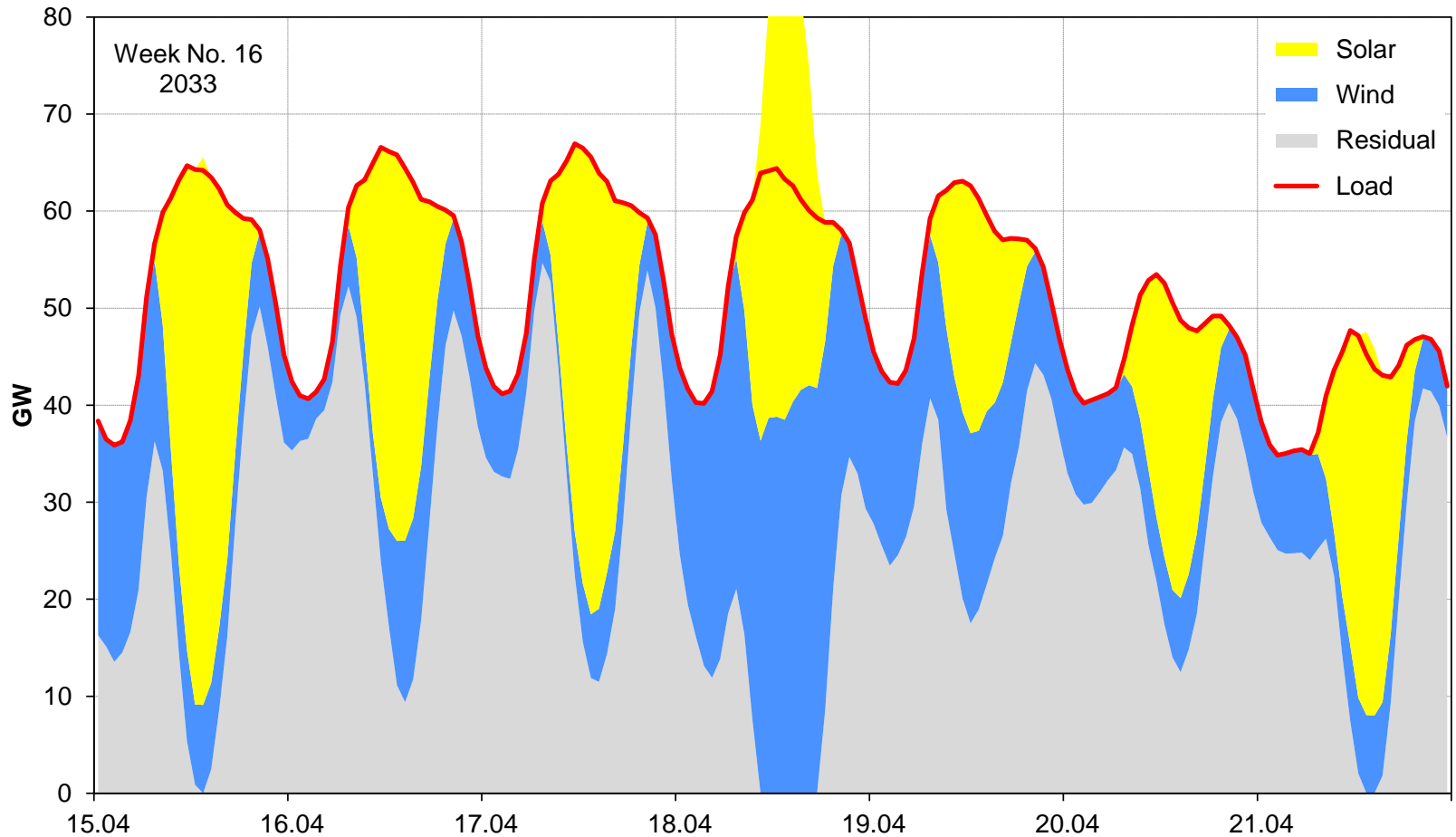
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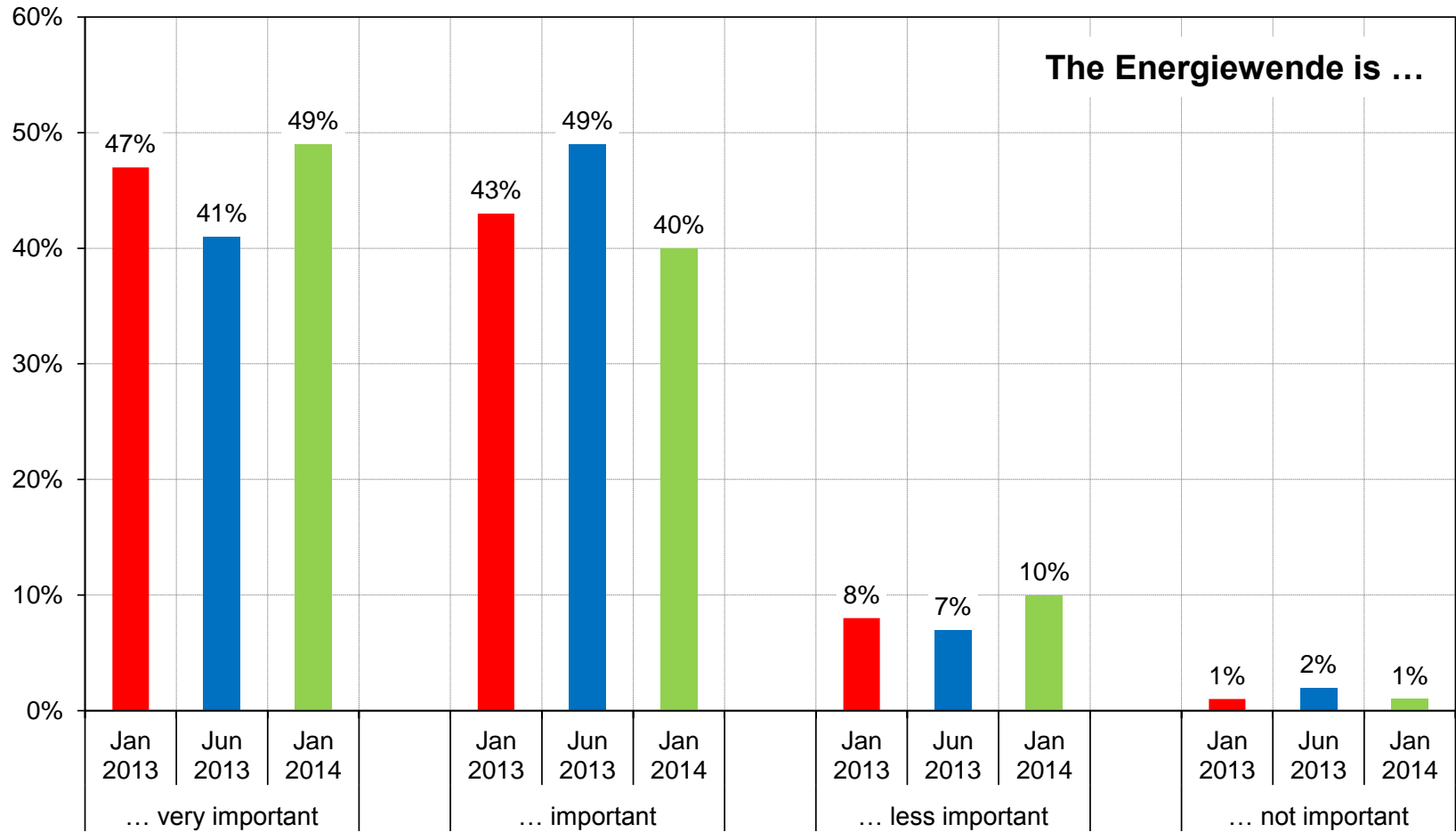
A windy and sunny week in Germany - 2033



- **Strong regulatory framework for the expansion of renewables**
 - Guaranteed grid connection
 - Priority dispatch
 - Guaranteed long-term feed-in tariff (based on costs)
 - Complementary regulations (licensing, land use planning etc.)
- **Results**
 - Major roll-out of renewables
 - Major cost decrease for onshore wind and solar (not for biomass)
 - New industries and businesses
 - Broad economic participation
- **Emerging challenges**
 - What future will feed-in tariffs (cost-plus-regulation) for renewables have for market shares above 25% in liberalized power market?
 - How to maintain broad economic participation (= support)

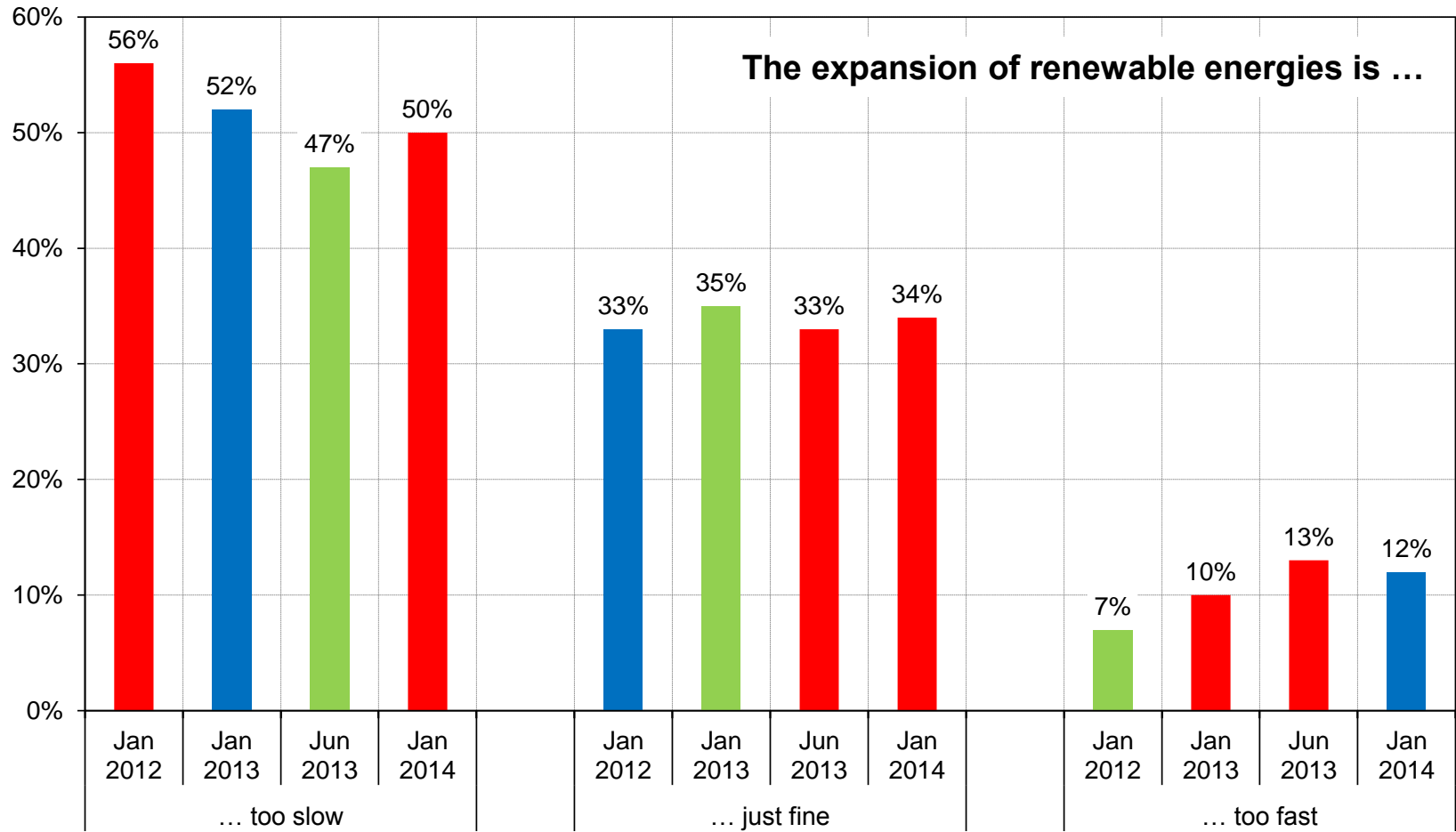
Public support for Energiewende

Polls continue to show high acceptance



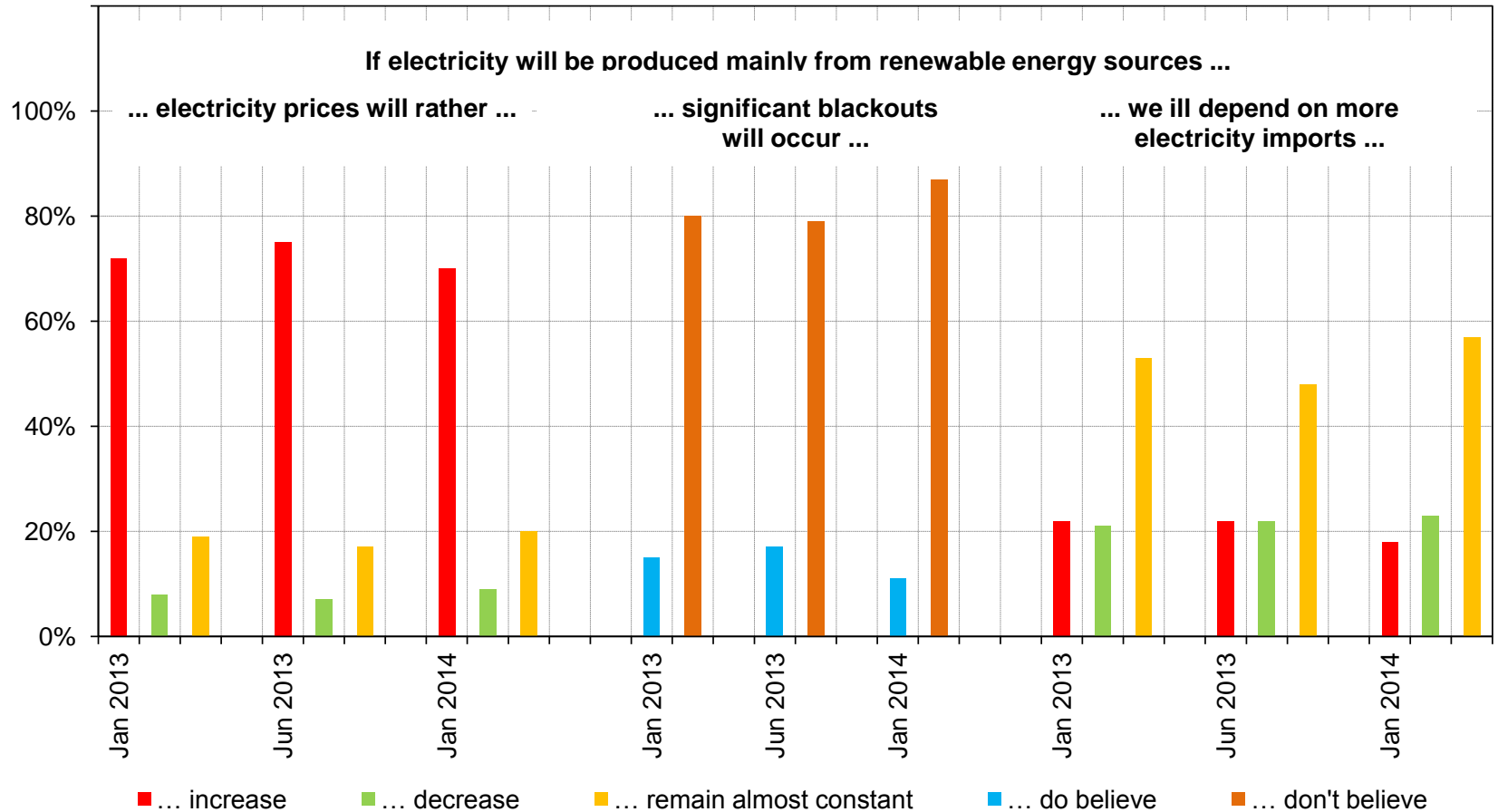
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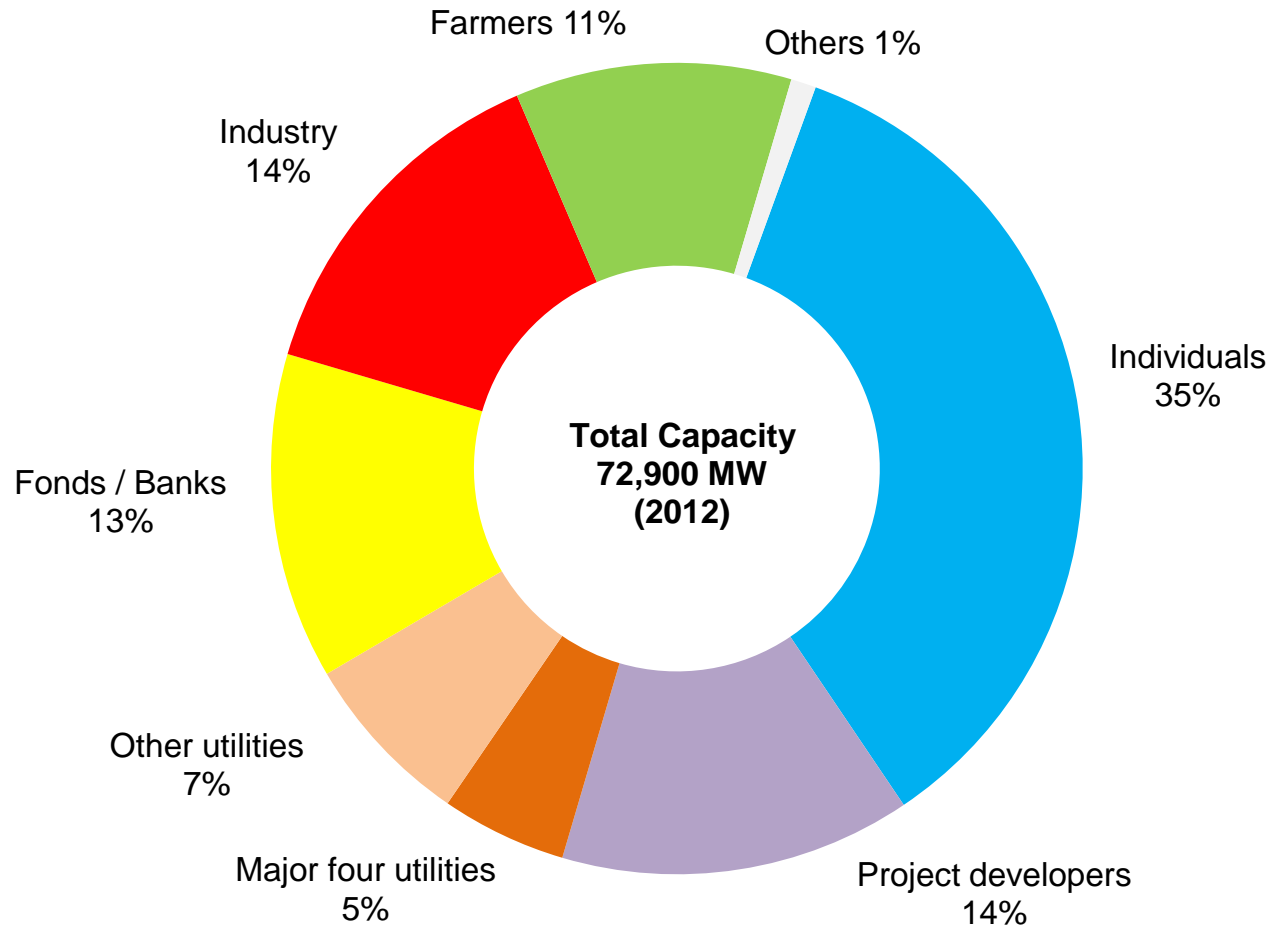
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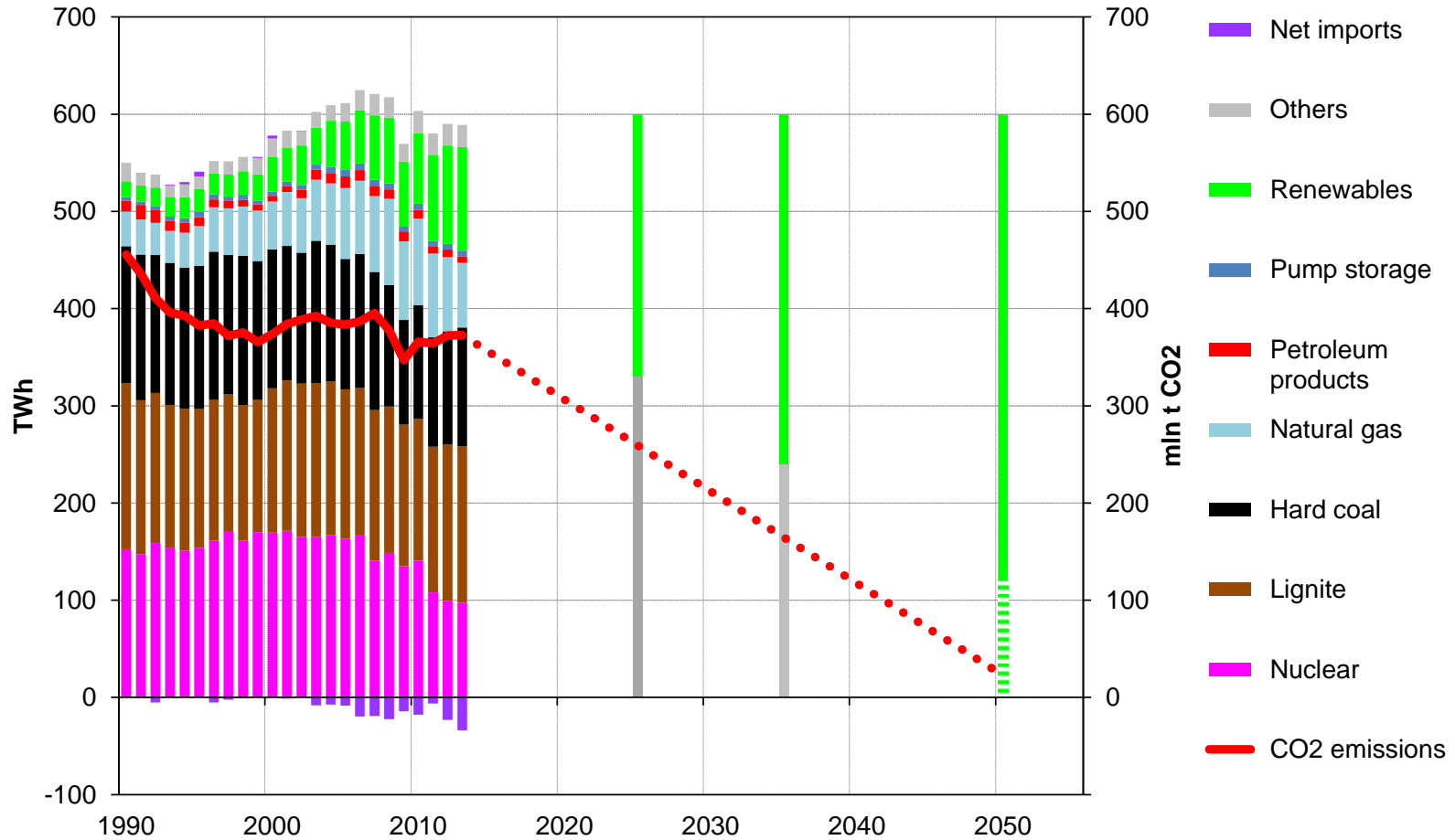
Expansion of power generation from renewables

New structure of players



- **The traditional German power system**
 - Running a (centralized) system based on 500 large generation units
- **The emerging new power System in Germany (as of summer 2014)**
 - approx. 1.2 million PV installations
 - approx. 30,000 wind power installations
 - approx. 10,000 biomass power plants
 - approx. 30,000 small- and medium-scale cogeneration plants
 - approx. 700 conventional power generation units
- **The need for a new market design**
 - for phase 1 of roll-out of renewables (0...25% market share)
investment certainty and broad economic participation are priority #1
 - for phase 2 a new balance needs to be found between priorities from phase 1 and the increasing need for coordination and an appropriate sharing of risks

Power sector decarbonization needs action beyond the expansion of renewables



- **Power sector**
 - Energy efficiency
 - Stronger role for low-carbon fossil generation (natural gas, cogeneration)
 - Massive infrastructure roll-out (in a densely populated country)
 - New market design
 - European integration
- **Building (heating) sector**
 - Much more stringent energy efficiency policies
 - Carbon-free energy supply for the heat market
- **Transport sector**
 - Modal shift to public and rail transport
 - Much more stringent energy efficiency policies
 - Carbon-free energy supply for the transport sector

- **A resource-poor and innovation-based country**
- **Strong public awareness drove and drives policy**
 - Environmental and nuclear awareness deeply rooted in society
 - Professional and strong NGOs
 - Progressive political parties took-up the issues quickly
- **Strong analytical capacities brought the energy transition to the mainstream**
 - Pioneering research institutions started 35...40 years ago
 - Mainstream research institutions changed course after political and economic opportunities became highly visible
- **Enabling structures for pioneering and political innovation**
 - Strong role of states and municipalities
 - Wide field for innovation among ~900 municipal utilities
 - Many innovative (technology & business) entrepreneurs
 - A robust regulatory framework for the phase-in period

**Thank you
very much**

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