Germany’s Coal Phase-Out. Insights from the German Commission on Growth, Structural Change and Employment ("The Coal Commission")

Third Regional Forum for Sustainable Development in Latin America and the Caribbean

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Santiago de Chile, 25th April 2019
The transformation of the German electricity system
The bigger picture

- **Nuclear Policy**
  - Breakthrough
  - Stagnation
  - Phase-out

- **Coal Policy**
  - Mandatory use of domestic coal
  - Shift to imported hard coal & hard coal decline
  - Decline & phase-out of hard coal & lignite

- **Renewables Policy**
  - Take-off & breakthrough
  - Stabilized growth
  - Main source of electricity

- **TWh**

- **Sources of Electricity**
  - Other renewables
  - Biomass
  - Solar
  - Wind
  - Hydro
  - Natural gas
  - Other fossil
  - Hard coal
  - Lignite
  - Nuclear

* 1950-1954: Western Germany only
The German Coal Commission
The challenges

Energy and climate policy

• power generation from coal is by far the largest single source of greenhouse gas emissions in Germany
• the coal-fired power plant fleet is quite diverse in terms of age and location
• it represents a significant share in (net) power generation (36% in 2017) as well as firm (net) capacity (40% in 2017)
• phase of coal phase-out runs parallel to the final phase of the nuclear phase-out (12% of net power generation, 9% of net firm capacity in 2017)
• German coal phase-out runs parallel to coal phase-out policies in other European countries

Employment and regional policy

• lignite industry (mining and power generation) employs approx. 20,000 workers directly and another 20,000 indirectly in the regions
• regional challenges are very different (Lusatian region as hot spot)
German energy & climate policy in a corporatist environment
The taxonomy of (non-permanent) commissions

Expert Commissions
- Expert Commission on the Monitoring Process "Energy of the Future"

Joint Parliament/Expert Commissions
- Study Commissions (“Enquete-Kommissionen”) of the Federal and the State Parliaments

Stakeholder Commissions with a (more or less) narrow mandate and/or (more or less) pre-defined outcomes
- Commission to Review the Financing for the Phase-out of Nuclear Energy
- Ethics Commission on Nuclear Phase-out

Stakeholder Commissions with a broad mandate and/or (more or less) open outcomes
- Commission on the Storage of High-level Radioactive Waste
- Commission on Growth, Structural Change and Employment (“Coal Commission”)
The German Coal Commission
Composition

• 3 representatives from industry/business associations, 3 representatives from trade unions, 2 representatives from energy industry associations
• 3 representatives from environmental NGOs, 1 representative from a renewable energy association
• 3 scientists specialized on energy & climate, 2 scientists specialized on structural change & labour market, 1 scientist specialized on innovation
• 3 representatives from non-energy companies
• 2 (retired) minister presidents from (East German) lignite mining states
• 1 representative from other organization
• 2 pro-coal representatives from lignite mining regions, 2 anti-coal representatives from lignite mining regions
• 3 MPs from the Federal Parliament (ruling coalition, no voting rights)
• Observers: coal mining states, federal ministries, Chancellery
The German Coal Commission
Recommendations & implications (1)

A programme on employment and structural change

Targets and implementation mechanisms for coal phase-out

- coal capacity -30% by 2022, -37% by 2025, -60% by 2030, complete phase-out by 2038/2035
- GHG emission reduction by 150…160 million t CO₂ by 2030 and by approx. 200 million t CO₂ by 2035/38

Embedding the coal phase-out in a broader energy policy (1)

- security of supply measures
- expansion of renewables
- network infrastructure roll-out
- electricity price compensation
- cancellation of EU ETS emission allowances
- modernization of taxes, levies and surcharges and carbon pricing
Embedding the coal phase-out in a broader energy policy (2)

- model regions and “real laboratories”: maintaining the general orientation as energy regions
- innovation support: developing a general orientation as innovation regions

A consistent review process

- 2023, 2026 and 2029 mandatory review (and add’l measures if needed)
- detailed proposal on indicators and procedures
Lessons learned (not only from the Coal Commission)
What energy transformation is really about

The conventional concerns and challenges on the future energy system become less relevant

- technologies are available or at least visible in the innovation pipeline
- costs (in terms of system costs for newly built systems and on a LCOE basis) are almost comparable (at moderate CO2 prices)

The real challenges from the transformation result from the needs for managing structural change (= modernization)

- new technologies with new technical characteristics (more diverse, variable production, distributed, digitized) and new coordination needs
- new cost structures (entering an extremely capital-intensive system)
- new structures of players and/or market/system participants
- new spatial patterns with new needs for network infrastructure
Lessons learned (not only from the Coal Commission)
Clear targets & robust strategies & flexible implementation needed

1. Paving the way – for energy efficiency, clean generation & flexibility options (renewables & complementary flexibility)
   - the German priority #1 for many years
   - new jobs (in new regions?) but also new distributional challenges

2. Designing the exit-game – for the non-sustainable capital stocks
   - a blind spot until the Coal Commission triggered a new approach
   - job losses in hotspot regions

3. Triggering the necessary infrastructure adjustments with sufficient lead-times
   - a blind spot for too long, long-term visions are needed
   - public acceptance is crucial and new distributional challenges

4. Making the necessary innovation work in time
   - targeted support and creating an ecosystem of innovation will make the economy ready for a sustainable future
The German Coal Commission
Deep dive (1): New phase of RES roll-out & the need for storage

Historical data

Legally binding EU legislation

National targets

- Geothermal
- Landfill gas
- Waste (biogenic)
- Biomass
- Photovoltaics
- Wind - offshore
- Wind - onshore
- Hydro

for 2030-2050 the typical range of projections is shown

Maximum effective load serving by renewable generation fleet

Conventional load range

0 100 200 300 400 500 600
GW

Conventional load range
The German Coal Commission
Deep dive (2): Old spatial patterns (and regional identities)

Low load / medium conventional region North
- Low load
- Medium nuclear capacities
- Low conventional capacities

High load / high coal region West
- High load
- High coal capacities
- High CHP capacities

Low load / high coal region East
- Low load
- High coal capacities
- High CHP capacities

Medium load / storage region Center
- Medium-/ high-load
- High pump-storage capacities

High load / high nuclear region South
- High load
- High nuclear capacities
The German Coal Commission
Deep dive (2): New spatial patterns (and regional identities)

High wind region North
Low load
High onshore/offshore wind

High load/medium RES region West
High load
Medium RES
High CHP
Coal phase-out

Low load/high wind Region East
Low load
High wind
High CHP
Coal phase-out

Medium load/infra-structure & storage Region Center
Medium/high load
Medium RES
High pump storage capacities
Large electricity transits

New DC corridors

SuedLink
SuedOstLink
Ultranet

SuedLink
SuedOstLink
Ultranet
Last but not least: The German coal phase-out in the context of other European efforts
Thank you very much

The report of the Coal Commission is available in English at:

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Backup
# Starting point: Energy transformation as a target- & policy-driven structural change of the energy system

<table>
<thead>
<tr>
<th>Year</th>
<th>Greenhouse gas emissions</th>
<th>Renewable energies</th>
<th>Energy efficiency</th>
<th>Nuclear energy (capacity)</th>
<th>Power from coal (capacity)*</th>
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<td>2011</td>
<td>45%</td>
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<td>2015</td>
<td>47%</td>
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<td>2017</td>
<td>54%</td>
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<td>2019</td>
<td>60%</td>
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<td>2020</td>
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<tr>
<td>2021</td>
<td>-100%</td>
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<td>2050</td>
<td>-80 to -95%</td>
<td>60%</td>
<td>80%</td>
<td>-50%</td>
<td>-80%</td>
</tr>
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</table>

Note: * according to the recommendations of the Coal Commission
Coal phase-out in Germany: a three-dimensional challenge
lignite vs hard coal, new vs old, East vs West

Graph showing the cumulative GW (cumulative) of lignite and hard coal power plants from 1960 to 2015, with distinctions between West and East Germany.
The German Coal Commission
Recommendations & implications (3)

The I3SEC programme on structural change

• infrastructure (transport, digitization)
• investment support
• innovation (set-up and funding of research institutions in the mining regions, demonstration projects, innovation zones)
• settlement of government agencies (incl. military)
• early retirement/adaptation allowance mechanisms (labour market policies following the blueprint of hard coal mining phase-out)
• civil society and community support programmes

Funding resources

• €1.3b annually for 20 years for specific measures (controlled by federal legislation), €0.7b annually for 20 years at the disposal of the States
• funds will be only partly additional (re-distribution of existing funding mechanisms)
The German Coal Commission
Recommendations & implications (4): Capacity buy-out

- **Base 2017:**
  - Other fossil: 20.0 GW
  - Natural gas: 18.0 GW
  - Hard coal: 22.7 GW
  - Lignite: 20.0 GW

- **Ref 2023:**
  - Other fossil: 18.0 GW
  - Natural gas: 15.0 GW
  - Hard coal: 19.3 GW
  - Lignite: 18.0 GW

- **Coal Commission 2025:**
  - Other fossil: 15.0 GW
  - Natural gas: 15.0 GW
  - Hard coal: 19.2 GW
  - Lignite: 18.1 GW

- **Ref 2030:**
  - Other fossil: 10.0 GW
  - Natural gas: 10.0 GW
  - Hard coal: 16.2 GW
  - Lignite: 13.9 GW

- **Coal Commission 2030:**
  - Other fossil: 10.0 GW
  - Natural gas: 10.0 GW
  - Hard coal: 16.2 GW
  - Lignite: 8.0 GW

- **Ref 2038/35:**
  - Other fossil: 10.0 GW
  - Natural gas: 10.0 GW
  - Hard coal: 0.0 GW
  - Lignite: 8.0 GW

**Fuel price sensitivity**
- Other fossil: 42.6
- Natural gas: 30 GW
- Hard coal: ~26 GW
- Lignite: ~26 GW
- Coal Commission 2038/35: 0 GW
The German Coal Commission
Recommendations & implications (5): Emission abatement

Fuel price sensitivity

Other fossil   Natural gas   Hard coal   Lignite

330   170…180 mn t CO₂
The German Coal Commission
Recommendations & implications (6)

The necessary embedding in a broader energy policy (1)

- security of supply
  - more stringent monitoring
  - will a new capacity mechanism become necessary (systematic investment framework, aka capacity market, new EU framework with 550 g/kWh threshold)?
  - new gas-fired capacity and/or other dispatchable capacities/flexibilities need to be commissioned from 2025 onwards

- expansion of renewables
  - 65% renewables in 2030 to be fixed in Renewable Energy Act (tender volumes etc.)
  - 65% renewables in 2030 to be fixed in network development

- network infrastructure roll-out
  - updated network development plans & legislation
The German Coal Commission
Recommendations & implications (7)

The necessary embedding in a broader energy policy (2)

- electricity price compensation
  - contribution from federal budget to transmission network access fees
  - potentially starting in 2023, volume (€2b annually?), updating, state aid approval

- cancellation of EU ETS emission allowances
  - basic legal EU framework exists, implementation provisions pending, volume to be fixed

- modernization of taxes, levies and surcharges and carbon pricing
  - evaluation and revision process need to be started soon
  - major implications for electricity costs, self-consumption, storage, power-to-X
The German Coal Commission
Recommendations & implications (8)

The necessary embedding in a broader energy policy (3)

- model regions and “real laboratories”: maintaining the general orientation as energy regions
  - funding
  - specific (experimental) framework provisions
- innovation support: developing a general orientation as innovation regions
  - sector integration
  - flexibility
  - hydrogen and power-to-X

The review process

- 2023, 2026 and 2029 mandatory review (and add’l measures if needed)
- detailed proposal on indicators and procedures