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Summary of the Position Paper

Accelerating the Expansion of Wind and Solar Power

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Despite widespread public acceptance, wind and solar power are not growing fast enough to meet Germany's climate targets. The following four priority areas are key to achieving a several-fold increase in the annual rate of expansion:

- A **proactive planning culture** incorporates the national and federal state expansion targets into the regional planning process. Ensuring clear, uniform nationwide nature conservation criteria and increasing staffing levels in the relevant authorities can help to expedite planning and licensing processes.
- Public acceptance can be strengthened through **greater public involvement from an earlier stage** and the **financial participation of local authorities and residents**. Participation processes should seek to unlock the public's positive creative potential and encourage them to experience the energy transition as a worthwhile collective endeavour.
- **National and federal state land allocation targets** can help to ensure that sufficient land is designated for wind and ground-mounted PV installations. In addition, multiple space uses can be supported by leveraging the potential of solar panels on suitable building roofs and promoting agrivoltaics and floating PV.
- In the future, most electricity will be generated from solar and wind power. It will therefore be necessary to modify the **electricity supply's technical infrastructure and regulatory framework** to ensure that wind and PV installations can contribute to system stability. It will also be necessary to determine whether reliance on imported renewable energy technologies poses a threat to the energy transition and, if so, how this threat can be countered.

Faster expansion of wind and solar power is key

In order to achieve the goal of climate neutrality by 2045, Germany's entire energy demand will need to be met by renewables within just over two decades. Wind and PV installations will be the main pillars of the future energy supply. They still have considerable untapped potential and are now among the cheapest technologies for generating electricity, thanks to the huge reductions in their cost. In principle, public acceptance is also high. The majority of the population wants more ambitious climate action and supports the energy transition, especially the expansion of wind and solar power.

Energy scenarios show that if the future energy supply is to be cost-effective, electricity generated from wind and solar power will also have to meet much of the energy demand in the heating and transport sectors and in industry. Consequently, electricity demand will still rise sharply despite major and necessary advances in energy efficiency.

A pronounced increase in the rate of expansion will be required in order to meet the German government's ambitious targets of 200 gigawatts of PV, 100 gigawatts of onshore wind and 30 gigawatts of offshore wind. By 2030, there will need to be a severalfold increase in annual new capacity compared to 2021, rising from approx. 5 gigawatts to 20 gigawatts for PV, from approx. 2 gigawatts to 10 gigawatts for onshore wind and from less than 1 gigawatt to 7 gigawatts for offshore wind.[2]

To achieve climate neutrality by 2045, total installed capacity will have to increase **fourfold** for onshore wind, up to **ninefold** for offshore wind and up to **eightfold** for PV compared to current levels.[3]

Barriers to faster expansion

Despite the significant cost reduction of wind and PV installations and high levels of public support for their expansion, in recent years the annual increase in new capacity for both technologies has fallen short of its former peaks. One reason for this is that the consequential costs of using fossil fuels are not fully reflected, either due to a lack of carbon pricing or, where it does exist, because carbon prices are too low. This prevents fair competition between the different technologies. Other barriers are found in planning and licensing practice and a lack of local acceptance of specific renewable energy projects:

- **Restrictive regional planning** practice and a **failure to designate sufficient land** hinders potential investments and renewable installation projects.

2 See BMWK 2022a.

3 The exact level of growth required will depend on various factors such as future electricity demand trends and the

- Processes can sometimes last several years due to **lengthy and complex licensing procedures** coupled with **staff shortages in the relevant authorities**.

- Although the public is generally in favour of the energy transition, implementation of concrete measures often encounters local opposition from **highly litigious parties**. Legal action can sometimes significantly delay new renewable energy projects.

- **Inadequate public involvement in planning processes** and a lack of **financial participation** results in failure to maximise potential support among the affected municipalities and local residents.

- **Automatic prioritisation of other interests** (military, radar, weather radar, earthquake monitoring stations, etc.) instead case-by-case consideration can hamper a project's implementation.

- **Unclear and open-ended nature and biodiversity conservation requirements** make it more difficult for authorities as they often give rise to legal disputes.

- **Excessive bureaucracy** (compulsory notification, business registration requirements, declaration on tax returns) deters property owners from installing solar panels on roofs and façades.

- The **energy industry's** current **regulatory framework**, which is designed for a centralised electricity supply, could also become a barrier if it fails to ensure fair allocation of electricity system costs, thereby creating perverse incentives.

- It will also be necessary to determine whether Germany's **near-complete reliance** on a single country (China) for **PV system imports** could pose a threat to the energy system transformation in years to come.

Public acceptance is key

Public opinion research has recorded consistently high public support for climate action and the expansion of renewables over a number of years. Solar and wind installations are among the technologies that enjoy the highest levels of support. Most people think we should all do our bit to support the energy transition. However, the practical implementation of the energy transition is frequently criticised for being expensive and slow, and for overlooking the concerns of local residents. Moreover, there are sometimes significant local problems, particularly with the implementation of wind power projects. Legal action is taken against 20% of wind installations during the licensing process, even though in many cases the majority of local residents are in favour of them.

It is thus necessary to find ways of implementing the energy transition that mobilise the significant potential support for the expansion of renewables among the public. Acceptance research has shown that offering people extensive opportunities to participate from an early stage makes it easier for them to be positive about change and identify with the energy transition as a collective endeavour.

A new, proactive and integrated planning and licensing culture

The planning and licensing processes should ensure that enough space is available for wind and PV installations and that projects can be implemented quickly enough. This will call for a reform of the legal framework. It is important for planning and licensing culture to view the energy transition as an opportunity and treat public participation as a resource. A focus on creative aspects ("visions of the local area", "development concepts", "project ideas") rather than negative aspects ("spatial vulnerability", "conflict minimisation") can help to mobilise the public's creativity.

Renewable energy installations are increasingly becoming a normal part of the landscape. Consequently, spatial planning should aim to incorporate these installations into the landscape as part of a positive reimagining of landscapes as a whole, rather than concentrating them in degraded, leftover spaces, as has largely been the case until now.

Multiple space uses can help to mitigate potential competition for space. This can be enabled by innovative solutions such as agrivoltaics and floating PV or building-integrated PV or greater use of roof-mounted PV.

An integrated system: putting renewables at the centre of the energy supply

Hitherto, the focus has been on trying to incorporate renewables into a system dominated by fossil and nuclear power plants through special regulations like the Renewable Energy Sources Act (EEG). But with renewables already accounting for about half of all electricity, this approach is unlikely to be feasible for much longer. Accordingly, a paradigm shift is required: in the future, volatile renewables must be at the centre of the system's technical design and of the market design. Technical infrastructure such as power grids, regulations governing the provision of system stability, and the design of the electricity market should all be geared towards enabling and supporting a reliable and affordable electricity supply in a system with a fast-growing percentage of volatile renewable energy.

Policy options: how can the expansion of renewables be accelerated?

In order to accelerate the expansion of wind and PV capacity, the ESYS working group proposes the following 12 policy options (POs) across 4 key policy areas:

Policy area 1:
Transforming planning and licensing processes

The regional planning level is key to enabling faster planning and licensing processes.

- **Policy option 1.1**:
  A **sustainable, integrated planning culture** incorporates the expansion targets established by policymakers into the formal planning process. Clear nature conservation criteria that are harmonised throughout Germany will help to make decisions more legally watertight, while extensive, statutory public participation from an early stage can help to prevent negative publicity and legal action.
- **Policy option 1.2:**
  Additional **staffing and professional development programmes** will allow the authorities to carry out legally watertight assessments and licensing procedures more quickly.

Policy area 2:
Strengthening a new, proactive planning culture through participation

A forward-looking, proactive and participatory planning culture enables earlier and more extensive public participation in the complex decision-making processes, giving people a chance to co-design the collective energy transition project. Opportunities for local actors to participate financially can also help to mobilise the significant potential public support for wind and PV installations.

- **Policy option 2.1**:
  Interactive information activities such as **decision theatres**, **planning cells** and **citizens' assemblies** provide a space for critical exploration of the complex issues involved in the energy transition and can nip potential conflicts in the bud.
- **Policy option 2.2**:
  Trust and acceptance can be strengthened by **embedding participation processes in the different planning stages**. It is important to ensure greater public participation in the early planning stages, when it is still possible to exert a significant influence on decisions concerning the identification and designation of suitable land, for example.
- **Policy option 2.3**:
  Making it mandatory to give a share of the revenue from wind and PV installations to the municipality where the plant is sited, as well as implementing models that help even small municipalities to invest in renewable installations can increase motivation to actively promote renewable energy projects among local politicians, civil servants and residents.
- **Policy option 2.4**:
  Citizen energy models should be strengthened in accordance with the relevant EU Directives. In particular, **renewable energy communities should be established** to support the use of locally generated electricity by the local community. Digital technology should be harnessed to enable innovative flexibility platform models, for example.

Policy area 3:
Creating the conditions to make more land available

The expansion of renewables requires space, and competes with other forms of land use such as agriculture. These conflicts can be mitigated through greater use of roofs and façades for solar power generation and through multiple space use solutions.

- **Policy option 3.1**:
  A **statutory land allocation target** for renewable installations could help to achieve a secure, climate-neutral energy supply by ensuring that sufficient land is designated for new installations. It would be up to the federal states to ensure that sufficient land is designated for wind and PV installations at the state, regional and municipal spatial planning levels to meet the agreed targets for each state.
- **Policy option 3.2**:
  Multiple space use solutions, especially involving PV installations (e.g. solar façades, agrivoltaics, floating PV) should be addressed and enabled by spatial planning and building regulations.
- **Policy option 3.3**:
  The widespread **installation** of solar panels **on suitable building roofs** can help to mitigate potential space use competition. This could be supported by stable financial incentives such as a higher feed-in tariff or market premium. One alternative or complementary option would be an obligation to install solar panels on new buildings and when renovating existing building stock.

Priority area 4:
Fully aligning the energy system with renewables

System stability and security of supply will increasingly have to be provided by wind and PV installations in conjunction with storage systems and more flexible consumption patterns. The electricity market design and other regulatory conditions relating to the energy supply must enable this and ensure that it is financially attractive enough.

- **Policy option 4.1**:
  Integrating volatile electricity generation in a manner that supports system stability will call for an appropriate ICT infrastructure and the development of the necessary power electronics.
- **Policy option 4.2**:
  A new, **integrated regulatory framework for the electricity market** should create incentives to ensure that renewable installations are built and operated in a way that supports system stability and that contributions to system stability are appropriately compensated.
- **Policy option 4.3**:
  It will be necessary to investigate whether Germany's current high **reliance** on a single country (China) **for PV module imports** could jeopardise attainment of the expansion targets. If this is found to be the case, and it is not possible to reliably diversify PV module sourcing, it will be necessary to establish whether the development of PV production in Europe could make a meaningful contribution to the German government's goal of achieving **energy sovereignty**, i.e. a robust energy supply safeguarded against crises and political intervention.

Table 1: Overview of the 12 policy options (POs)

According to the German government's climate policy, wind and solar power will be the main pillars of tomorrow's climate-neutral energy supply and are thus key to future economic development. Consequently, it is necessary to ensure that these sources of electricity are expanded quickly enough and that the energy transition is driven forward as a collective project.

The Academies' Project "Energy Systems of the Future"

The Position Paper *Accelerating the Expansion of Wind and Solar Power* evolved within the framework of the Academies' Project "Energy Systems of the Future". In interdisciplinary working groups, about 100 experts are working on different courses of action for the pathway to an environmentally sustainable, safe and affordable energy supply.

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