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The four German transmission system operators (TSO's) are making an important contribution to the implementation of the "Energiewende" in Germany. This draft of the 2012 grid development plan shows the grid expansion that is required over the next ten years to achieve this.

The grid development plan relates to the expansion requirements in the German onshore power transmission system, and is based on the legal principles of the Energy Industry Act (§ 12 a-d EnWG). With this plan the TSO's are laying the foundations for security of supply and stable grid operation over the next ten years, taking into account the integration of renewable energy sources and the development of a European electricity market under the stipulated energy industry framework conditions. Grid optimisation and reinforcement measures were prioritised in comparison with expansion measures. There is a significant need for development throughout Germany. The main focus is on efficient north-south connections. Grid reinforcements and optimisations are required on existing routes over a length of 4,400 km. The new construction requirements include 1,700 km of three-phase line routes and 2,100 km of corridors for high voltage direct current lines. The total investments in the next ten years for the expansion of the transportation system amount to approximately 20 billion Euros.

The GDP contains four generation and consumption scenarios that have been authorised by the Federal Network Agency and have undergone public consultation beforehand. It also meets all of the requirements laid down by the law and the regulatory authority. The grid expansion requirements are essentially determined by input variables such as the type, quantity and geographical distribution of regenerative generation, the number of available conventional power stations and the obligation for full acceptance and further transport of the regeneratively generated energy. Three of the four scenarios relate to the target year of 2022. In one of the scenarios (A 2022) the intended proportion of power/heat coupling in relation to power generation, the lowering of primary energy consumption and the reduction of greenhouse gas emissions are not fully achieved. The assumptions of scenario B 2022 are based on the leading study that was carried out by the BMU in 2010, and the scenario was also examined in a forecast for 2032 (scenario B 2032) in order to establish the extent to which the grid expansion measures prove to be necessary in the longer term perspective. Scenario B fulfils all of the requirements for the year 2022. The grid expansion resulting from scenario B 2022 therefore represents the results of the GDP, and the set of measures in this respect is submitted for consultation. Scenario C depicts the aggregation of the goals of the federal states with regard to energy policy. It goes beyond the expansion expectations for renewable energy sources in scenario B 2022, but is exceeded by the forward projection of scenario B until 2032 with regard to the use of regenerative energy. Consequently, scenario B 2022 depicts a reliable development path for grid expansion. It is unlikely that any of the calculated measures in this scenario will be dispensable.

GDP 2012 shows the need for transmission between start and end points. Start points are usually in regions with excess energy, and the end points are in regions with high consumption or the locations of nuclear power stations that are being





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shut down by 2022. Specific route corridors will not be defined until the federal planning is carried out by the BNetzA (Federal Network Agency) or in the regional planning of the German federal states. Neither future power stations, locations for renewable energy systems nor a future market design are defined in GDP 2012, nor does it contain recommendations or optimisation suggestions.

The calculated transmission requirement arises under the given prerequisites and the input variables that are determined by the respective scenario. The packages of measures are inter-coordinated. The results of the GDP cannot be freely combined and are not interchangeable. A cut-set of the scenarios would not necessarily be a reliable grid. This would not guarantee transport capacity, system stability and system safety.

Line construction measures that are already planned were assumed to have been implemented. If they are not yet under construction, they have been checked for feasibility with regard to the necessity thereof. When this took place, the functionality of an EnLAG new construction project (Weier - Villingen) and a recabling project (Hamburg North - Hamburg East) were deemed to be no longer necessary because of the new grid topology. As a consequence, these measures were removed from GDP 2012.

As well as the expansion of the 380 kV three-phase current grid, high-voltage direct current connections (HVDC) are planned for the expansive transmission requirements from north to south. These make low-loss transmission possible over long distances, and stabilise the three-phase current grid using modern technology. The section-by-section cabling of HVAC connections is technologically feasible. The decision on whether to do this is not the subject of GDP 2012, but will be made within the scope of further route planning, federal planning or as part of the approval procedure. As well as the use of direct current technology, additional optimisation and expansion of the 380 kV three-phase current network is required for long-distance transmission. In order to minimise the need for new routes, the intention is to implement this expansion using the routes of the current 220 kV grid wherever possible. The combined use of DC and AC technology that is suggested in the GDP will make it possible to have an overall optimisation of the transmission network for the supply tasks that have been on the increase and future long-distance transport requirements with regard to grid stability, cost-effectiveness and use of space.

The financial investments calculated in the GDP reflect the extensive amount of development work that is required. The cost of the offshore grid is not included. However, this cost represents a comparatively low proportion of the overall costs of the "Energiewende", but must be regarded as absolutely necessary for the successful implementation of the plan. The TSOs are prepared to fulfil their legal assignment to provide and operate a safe and reliable electricity supply system as the basis for a successful "Energiewende". In order to implement this ambitious investment programme, both general social and political support at all levels and the planning and regulatory framework will be decisive.

The grid expansion is an elementary constituent of a successful "Energiewende". The speed of the grid expansion determines the speed of the "Energiewende". If it continues to lag behind the expansion speed of the generation systems that are





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based on renewable energy, the goals of the "Energiewende" and the security of supply are at risk. Dispensing with the optimisation, reinforcement and expansion of the transmission network would also result in high expenditure elsewhere due to the shared market area falling apart in Germany and the formation of zones with different wholesale prices for electricity (so-called market splitting), additional regional shut-offs of regenerative energy sources and consumers (infeed management) and ever-increasing costs for redispatch, for example. As well as the transmission network, grid expansion is also needed for the distribution network level and for the offshore connection.

GDP 2012 forms the basis for the federal requirement plan. Success factors for the quick implementation thereof are rapid and meaningful approval procedures, clear role distribution with acceptance of responsibility by all those concerned (mainly in the politics and administration areas) and wide acceptance by means of honest information, dialogue and early involvement of the affected public. The GDP that has already been accepted by the BNetzA is the binding basis for grid expansion planning, and a federal requirement plan act will then define the energy management need in the same way as the EnLAG.

This draft of the 2012 grid development plan will be submitted for public consultation by the TSO's by 10th July 2012 and will be accompanied by many information and dialogue events for stakeholders. Feedback from the consultations will flow into GDP 2012. The TSO's are hoping for committed consultation of this draft and are convinced that a consensus-driven result can be achieved, whereby the GDP process will also encourage social debate about future energy policy.

