

TYNDP 2017

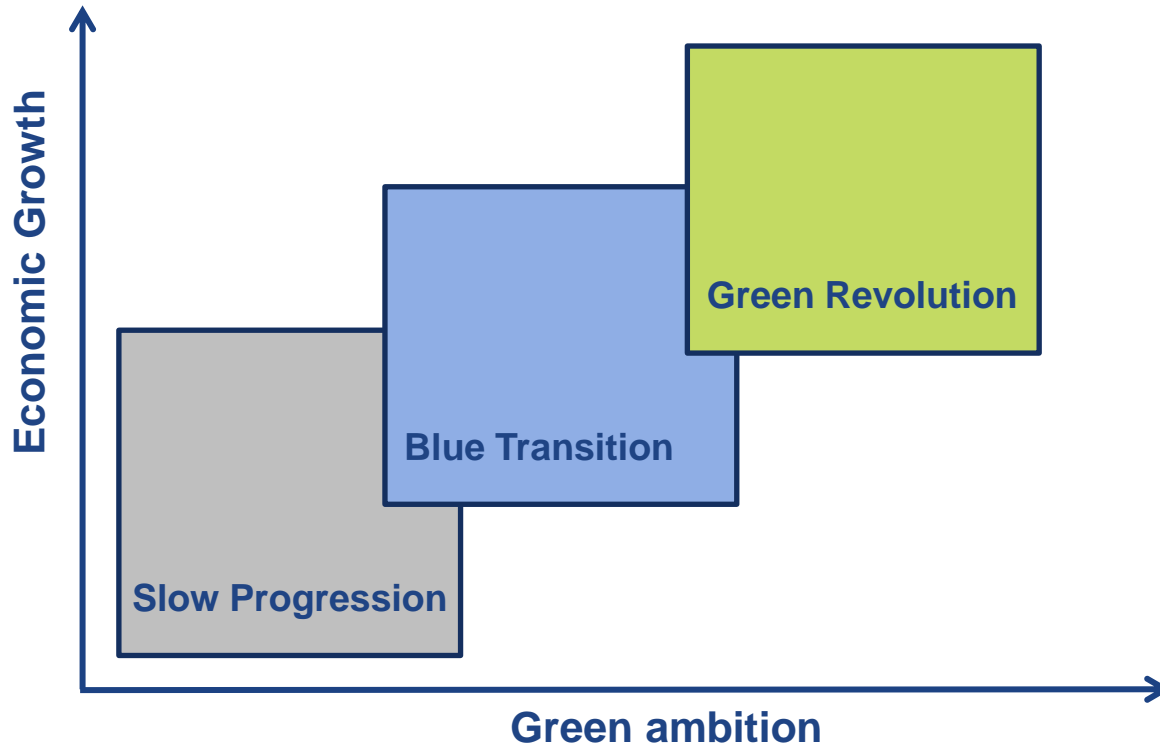
Scenarios story lines

ENTSO-G System Development Area



Demand Scenarios

ENTSOG has developed 3 story lines for TYNDP 2017 scenarios



Demand Scenarios: the story lines



TYNDP 2017 Scenarios	Slow Progression	Blue Transition	Green Revolution
Energy Policies/ Regulation	2050 targets not realistically reachable	Mainly on track with 2050 targets [closure of coal-fired power plants (regulation)]	On track with 2050 targets
Economic conditions	Limited growth	Moderate growth	Strong growth
Green ambitions	Lowest	Moderate	Highest
CO2 price	Lowest CO2 price (limited spread of carbon taxes)	Moderate CO2 price (carbon taxes mainly spread)	Highest CO2 price (carbon taxes well spread)
Fuel prices	Highest fuel prices [expected gas price > coal price]	Moderate fuel prices [expected gas price > coal price]	Lowest fuel prices [expected gas price > coal price]
Internal energy market	Well functioning, low MS cooperation	Well functioning, moderate MS cooperation	Well functioning, strong MS cooperation
Renewables develop.	Lowest	Moderate	Highest
Gas in heating sector			
Energy Efficiency	Slowest improvement	Moderate improvement	Fastest improvement
Competition with electricity	Limited gas displacement by elec. (new buildings)	Limited gas displacement by elec. (new buildings)	Gas displaced by electricity (district heating, heat pumps)
Electrific. of heating	Lowest	Moderate	Highest
Gas in power sector			
Gas vs Coal	Coal before Gas	Gas before Coal (on regulatory basis)	Gas before Coal (on regulatory basis)
Gas in transport			
Gas in transport	Lowest penetration	Highest penetration	Moderate penetration
Electricity in transport	Lowest penetration	Moderate penetration	Highest penetration
Expectations regarding EU overall gas demand	Expected to remain stable	Expected to increase	Expected to decrease



Slow Progression – story line

The economic growth is limited. However, the green ambitions are the lowest and so the energy generation mix stays generally the same as today. Penetration of RES is at its lowest level as there is limited support for renewables in combination with a low CO2 price. Green solutions are mostly not realized because of financial reasons; energy efficiencies are at their slowest improvement. European member states are well functioning but show a low level of cooperation which leads to less ambitions to find a common CO2 emissions reduction goal. Hence, 2050 targets are not realistically reachable. Overall, this scenarios show stagnation in natural gas demand.

Slowest level of improvement in energy efficiency as there is almost no financial support. Insulation and device replacement just play a minor role; carbon-neutral buildings are too expensive for the masses. Heating for existing houses stays mainly with their current installation; however the order for heating for new building follows the order district heating, heat pumps and gas.

Limited economic growth combined with slow improvements in energy efficiencies are the main characteristics of the commercial sector. The industrial sector shows similar characteristics as the commercial one.

Lax European incentives lead to the lowest RES development and to low pressure regarding the change in usage to less polluting fuels. Due to this fact, coal is mostly used as the preferred economical fuel for power generation instead of gas. Hydro-storages are developed on a national level, nuclear power remains on a reasonable level. Back-up capacities for RES fluctuation are coming from both gas- and coal-fired capacities. However, economically coal is being used more often as back-up. A slow development in energy efficiency and limited gain in the usage of electricity for heating and transport leads to just a slight increasing electricity demand.

Transport

Gas/Electricity usage: Due to the limited economic growth and hence a low financial support, improvements and penetration of both gas and electricity technology has limited success in this sector.

LNG as fuel becomes slightly more popular in smaller ships. However, container ships will not change. Cars, trucks and commercial vehicle fleets will run mostly on oil products even though there is some electrification in the vehicles market and penetration of LNG (even if slower than in the other two scenarios) in HGV/HDV.

Overall, oil keeps its position as the fuel mostly used in transportation and will not be replaced in the futures energy mix.

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Slow Progression (1)

General conditions

- Limited economic growth
- Actions disaligned from green ambitions
- Difficulties in financing green solutions
- EU targets until 2050 out of sight
- Low CO2 price
- Low level of cooperation between member states

Residential sector

- New buildings insulated as legally required, heated by
 1. District heating
 2. Heat pumps
 3. Gas
- Continuity in stock

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Slow Progression (2)

Industrial & Commercial sector

- Limited growth
- Slow improvements in energy efficiency

Electricity sector

- Moderate electricity demand increase
 - Limited efficiency gains
 - Limited growth in most sectors
- Continuation of recently observed market behavior (Coal before gas)

Transport sector

- LNG more popular as fuel for smaller ships
- Cars and commercial fleets mostly run on oil products
- Some electrification (cars) and LNG usage (HGV/HDV)



Blue Transition – story line

This scenario shows efficient achievement in terms of green ambitions under a context of moderate economic growth. Thus, the penetration of RES is still higher than in the Slow Progression scenario but does not reach the level of the Green Revolution Scenario. Europe is mainly on track with the 2050 carbon targets supported by public acceptance and backed by a moderate CO₂ price. However, there is a limited realization of infrastructure projects supporting RES due to financial reasons. The internal energy market is well functioning. European member states cooperate, but to a lesser extent than in the Green Revolution Scenario which leads to a lack of aligned ambitions regarding the reduction of CO₂ emissions. Efficiencies for given technologies undergo a moderate development process. European regulation paves the way for the successive closure of coal-fired power plants to foster the use of more environmental-friendly fuels. As the coal capacities will almost disappear gas becomes more favoured as base-load and back-up capacity. Due to this trend, this scenario expects overall an increasing gas demand in the future.

Improvement of energy efficiency is on a moderate level as there is lower financial support for insulation and device replacement as in the Green Revolution Scenario. Carbon-neutral buildings are too expensive for the majority of the consumers and are rarely built.

Heating for existing houses stays mainly with their current proven technologies (largely based on gas). When existing (gas and oil) boilers are replaced, the old ones are substituted by condensing boilers, where gas is available. However the order for heating for new building follows the order district heating, heat pumps and gas.

Moderate economic growth combined with improvements in energy efficiencies are the main characteristics of the commercial sector.

The industrial sector shows similar characteristics as the commercial one.

National regulations will lead to a successive closure of coal-fired power plants. No approvals for new coal-fired power plants are given; there is only a limited extension of existing ones. However, this “closing process” does not start immediately and with a different speed depending on the country. In contrast, a legal framework supports efficient electricity production from gas. Thus, gas-fired power plants are used more often in base-load and remain as back-up capacity for RES variations. Hydro-storages are developed on national levels, nuclear power remains on a reasonable level. Due to lower efficiency gains and less usage of electricity for heating and transportation than in the Green Revolution Scenario the overall electricity demand increases moderately.

Transport

Gas usage: Given the general conditions which are attached to this scenario gas in the transport sector shows the highest penetration among the scenarios. High financial support of natural gas, along with favourable economic conditions, lead to the usage of this fuel in private cars and commercial car fleets. LNG becomes more favoured as fuel in sea-born transportation. Smaller ships switch to this fuel and container ships will also change.

Electricity usage: Electrification in the transport sector shows a moderate penetration as the RES development is on a moderate level. Electric cars receive financial support but not in the same extent than in the Green Revolution Scenario.

There is a tendency to replace significant market shares of oil as the main fuel in transportation.

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Blue Transition (1)

General conditions

- Moderate economic growth
- Efficient approach for achieving green ambitions
- RES development, Public acceptance for required infrastructure
- Mainly on track EU targets until 2050
- Moderate CO2 price
- Energy market well functioning, cooperation and individuality

Residential sector

- New buildings better insulated, heated by
 1. District heating
 2. Heat pumps
 3. Gas
- Affordable solutions in stock (condensing boilers)

Blue Transition (2)

Industrial & Commercial sector

- Moderate growth
- Improvements in energy efficiency

Electricity sector

- Moderate electricity demand increase
 - Efficiency gains
 - Moderate growth in most sectors
- National regulation inclined to close the old coal plants and less likely to approve new ones
- (Hydro-) storages developed on national levels

Transport sector

- LNG main fuel for ships
- Support for electric cars and natural gas vehicles (private cars and commercial fleets)
- Significant market shares of oil are replaced



Green Revolution – story line

This scenario is characterized by favourable economic conditions and high green ambitions backed by a high RES development. Realization of environment targets and their fulfilment is set at highest priority and backed by public acceptance. The European economy is prospering enabling a high support for renewable energy in the long-term perspective. Out of the 3 scenarios, this one is mostly in line with the EU targets until 2050. Efficiencies for given technologies undergo a fast development, the CO2 price is at its highest level. The internal energy market is well working, European member states are characterized by a strong cooperation, especially regarding the reduction of CO2 emissions. Infrastructure projects which have positive impact to reach the environment targets will be realized in time. As a significant part of the energy comes from renewables, this scenario expects generally an overall decreasing trend in fossil fuel usage, especially in coal but also in gas demand.

Strong financial support leads to higher penetration of cost intensive energy solutions like heat pumps and energy from biomass and also supports enduring device replacement as well as a high rate of house insulation. Energy efficiency shows the highest improvements and leads overall to lower energy intensity. Carbon-neutral buildings are very popular and backed by a high performance in energy certificates. Houses mainly get heated through the access to district heating and heat pump, less by gas.

The industrial sector shows similar characteristics as the residential one. Moreover, high efficiency and lower energy intensity leads to a stable industrial energy demand. Energy from biomass and more electrification (“power to heat”) are used for industrial purposes, Carbon Capture Storage or Utilisation (“CCS” / “CCU”) contributes to the reduction of CO2 emissions.

Highest penetration of renewables supported by regulation fosters the use of less polluting fuels. Hydro-storages are centralized, nuclear power remains on a reasonable (depending on national view) level . RES backup-capacities come mainly from gas-fired power plants. Heating demand and the spread of electric cars are overcompensating gained energy efficiency and leads to an increasing electricity demand (highest of the scenarios).

Transport

Gas usage: Gas in the transportation sector shows a moderate penetration with some financial support. LNG becomes the main fuel for ships (small and container ships) and HGV/HDV. Cars will mostly run on electricity.

Electricity usage: The high overall RES development leads also to the highest penetration of electrification in the transport sector among the different scenarios. In addition, electrification in this sector is backed by a strong financial support.

On the long-run oil is being replaced as the main fuel in the transportation sector and plays a minor role in the future energy mix.

Green Revolution (1)

General conditions

- Favorable economic conditions
- High green ambitions
- High RES development, Public acceptance for required infrastructure
- In line with EU targets until 2050
- Highest CO2 price
- Energy market well functioning, strong cooperation

Residential & Commercial sector

- Access to district heating and heat pumps
 - Cost intensive solutions for device replacement
 - High rate of house insulation
 - Popularity of carbon-neutral buildings
- } High performance in energy certificates

Green Revolution (2)

Industrial sector

- High efficiency/lower energy intensity
- Energy from biomass, electrification
- Carbon Capture Storage or utilisation

Electricity sector

- Heating (+)
 - Electric cars (+)
 - Energy efficiency (-)
 - Highest penetration of Renewables (backup: gas)
 - Centralized hydro-storages
- } Increased electricity demand (highest)

Transport sector

- LNG main fuel for ships and HGV/HDV
- Cars run (mainly) on electricity
 - Strong financial support
 - Replacement of oil in sight



Thank You for Your Attention

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