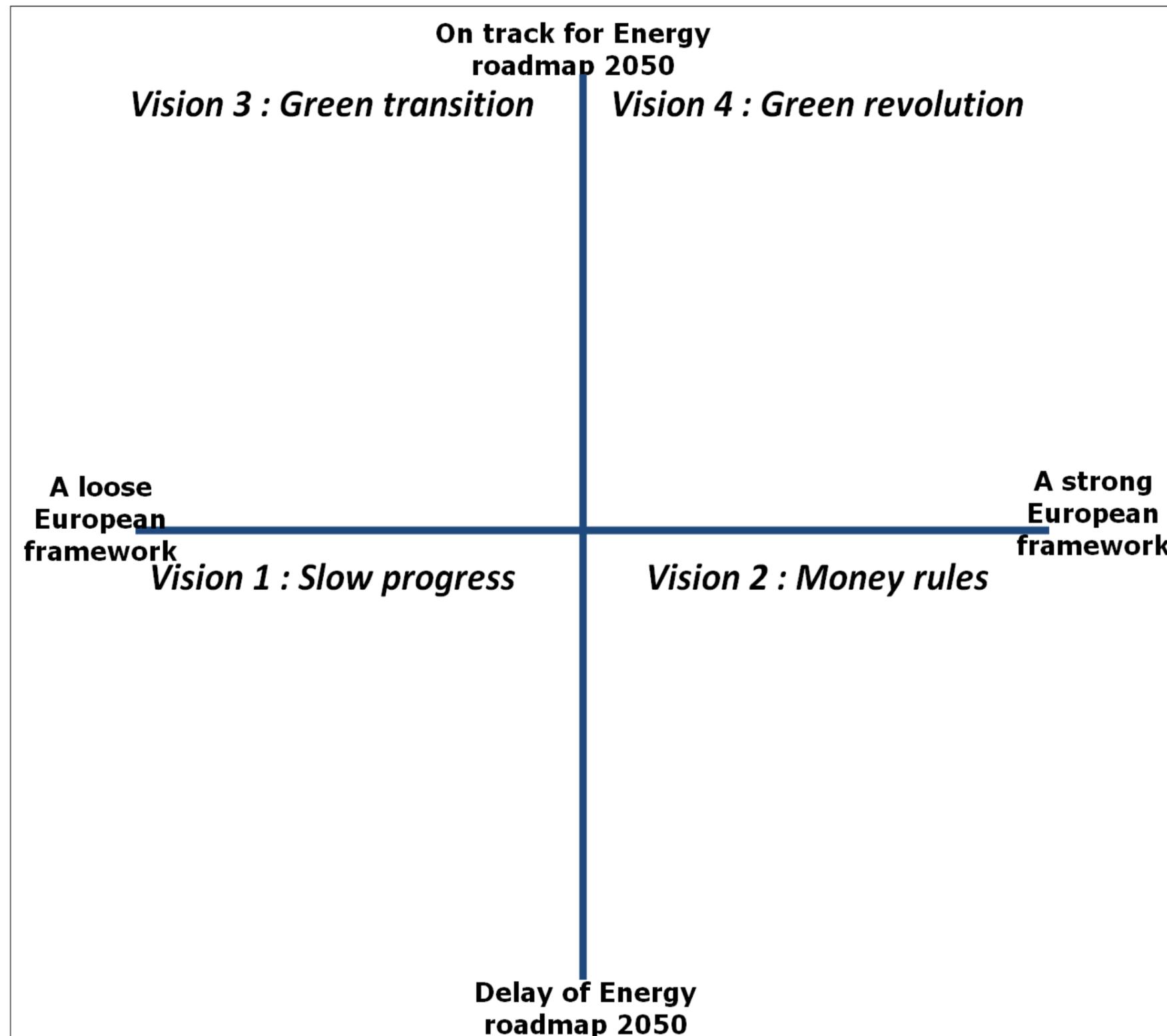




European Network of
Transmission System Operators
for Electricity

ENTSO-E 2030 VISIONS -> TYNDP 2014



	Vision 1 : Slow progress	Vision 2 : Money rules	Vision 3 : Green transition	Vision 4 : Green revolution
Economic and financial conditions	Less favourable	Less favourable	Favourable	Favourable
Focus of energy policies	National	European	National	European
Focus of R&D research schemes	National	European	National	European
CO₂ prices and primary energy prices	Low CO ₂ prices and high primary energy prices	Low CO ₂ prices and high primary energy prices	High CO ₂ prices and low primary energy prices	High CO ₂ prices and low primary energy prices
Electricity demand	Lowest level	Higher than in Vision 1	Higher than in Vision 2	Higher than in Vision 3
Demand respons potential	Used as today	Partially used	Partially used	Fully used
Electric vehicles	No commercial break through of electric plug-in vehicles	Electric plug-in vehicles (with flexible charging)	Electric plug-in vehicles (with flexible charging)	Electric plug-in vehicles (with flexible charging and generation)
Heat pumps	Implemented (although not evenly spread around Europe)	Implemented (although not evenly spread around Europe)	Implemented (although not evenly spread around Europe)	Much more heat pumps implemented (although not evenly spread around Europe)
Back-up generation	Level of back-up generation higher than in Vision 2 but lower than in Vision 4	Lowest level of back-up generation	Highest level of back-up generation	Level of back-up generation higher than in Vision 2 but lower than in Vision 3
Nuclear	National view	Public acceptance	National view	Public acceptance
CCS	Not commercially implemented	Partially implemented	Not commercially implemented	Fully implemented
Storage	As planned today	As planned today	Decentralised storage (limited amount but higher than in Vision 4)	Mainly additional centralised hydro storage + some decentralised storage
Smart grid solutions	Partially implemented	Fully implemented	Partially implemented	Fully implemented

Vision 1 : “Slow progress”

Economic and Market

The general framework of this Vision 1 “Slow progress” is that the economic and financial conditions are less favorable than in Visions 3 and 4 and as a consequence national governments have less money to reinforce existing energy policies. Furthermore, the absence of a strong European framework is a barrier to the introduction of fundamental new market designs that fully benefit from R&D developments. Furthermore, the opting for parallel national schemes regarding R&D expenses also result in a situation where major technological breakthroughs are less likely due to suboptimal and repeated R&D spending.

Since no reinforcing of existing policies occurs carbon pricing (e.g. the EU Emissions Trading System, carbon taxes or carbon price floors) remains at such a level that baseload electricity production based on hard coal is preferred to gas. Carbon and primary energy prices will be based on the current policies scenario of the IEA in their WEO 2011. This means that countries with a lot of hard coal in their energy portfolio are likely to be net exporters.

Demand

There is no major breakthroughs in energy efficiency developments (e.g. large scale deployment of micro-cogeneration or heat pumps as well as minimum requirements for new appliances and new buildings) due to a lack of regulatory push. There are also no major developments of the usage of electricity for transport (e.g. large scale introduction of electric plug-in vehicles) and heating/cooling. As a consequence electricity demand is expected to grow at a slower rate than in the other visions. Furthermore, no effort is made, through an adaption of the market design, to use the demand response potential that would allow to partially shift the daily load in response to the available supply.

Generation

The future generation mix is determined by national policy schemes that are established without coordination at a European level. Due to a lack of financial resources and construction delays due to permitting issues, the generation mix in 2030 fail to be on track for the realization of the energy roadmap 2050. If the energy objectives 2020 are only realized in 2030 then the need for additional back up capacity in 2030 would remain at the same order of magnitude as that currently estimated for 2020. This back-up capacity is likely to come from gas units since demand response potential and additional hydro storage are not significantly developed in this vision. However due to the limited size of the back-up capacity the need for flexible baseload capacity remains reasonable and it is not likely that gas will push out hard coal for baseload electricity generation.

This vision also takes into account a growing public opposition to nuclear, despite it being a low-carbon technology, in the aftermath of the Fukushima Daiichi nuclear disaster. Nevertheless the vision permits deviations if this is in line with the current national view. In general it is assumed that the financial community maintains its refusal to invest in this technology on a merchant basis and that technology-specific support schemes are not likely. The less favorable economic and financial conditions also results in the assumption that commercial deployments of CCS infrastructure beyond the planned demonstration plants is not realistic.

Grid

Distribution grid and transmission system connected as today. There is a certain amount of price elastic demand and smart communication enabling distributed resources to balance the RES fluctuation. However it is assumed that this does not fundamentally change the load pattern. The impact of electric vehicles is also assumed to be negligible in this Vision (no vehicle to grid connections).

Vision 2 : “Money rules”

Economic and market

The general framework of this Vision 2 “Money rules” is that the economic and financial conditions are less favorable than in Visions 3 and 4 and as a consequence national governments have less money to reinforce existing energy policies. However there is a strong European framework but due to the economic and financial outlook the introduction of fundamental new market designs and R&D expenses focuses on cost cutting and not the goals of the Energy Roadmap 2050.

Since no reinforcing of existing policies occurs carbon pricing (e.g. the EU Emissions Trading System, carbon taxes or carbon price floors) remains at such a level that baseload electricity production based on hard coal is preferred to gas. Carbon and primary energy prices will be based on the current policies scenario of the IEA in their WEO 2011. This means that countries with a lot of hard coal in their energy portfolio are likely to be net exporters.

Demand

The breakthrough in energy efficiency developments (e.g. large scale deployment of micro-cogeneration or heat pumps as well as minimum requirements for new appliances and new buildings) and the development of the usage of electricity for transport (e.g. large scale introduction of electric plug-in vehicles) and heating/cooling focus on possible economic benefits. As a consequence the electricity demand is expected to grow at a higher pace than in vision 1 “Slow progress” due to the fact that the introduction of these new uses of electricity outweighs any energy efficiency improvements. Furthermore, the demand response potential is partially used to shift the daily load in response to the available supply, because it allows a saving on back-up capacity and it is cheaper than storage.

Generation

The future generation mix is determined by a strong European vision that faces a lack of financial resources and construction delays due to permitting issues that result in a delay in the pathway to realization of the energy roadmap 2050. If the energy objectives 2020 are only realized in 2030 then the need for additional back up capacity in 2030 would remain at the same order of magnitude as that currently estimated for 2020. Since there is a European common energy framework the need for back-up capacity will be lower than in vision 1 “Slow progress” and this back-up capacity is likely to come from demand response as much as possible since it is cheaper than building additional gas units or storage. In this vision we can assume 50% of the maximum demand response capacity of 10% is used. This vision takes into account that no technology is preferred and that they compete with each other on a market basis with no specific support measure. Furthermore, decarbonisation is only driven by carbon pricing (no additional policies are assumed if carbon prices are too low to ensure a lower usage of coal fired units) and an assumption of public acceptance of nuclear. The European subsidies for the demonstration of CCS at full-scale are intensified in order to speed up the successful commercial deployment of CCS infrastructure.

Grid

Distribution grids and transmission systems connected by an advanced monitoring, control and communication link. Distribution grids become active [by-directional electricity flows]. The option of a potential bi-directional energy exchange with the grid (“vehicle-to-grid” or V2G approach) for electric vehicles is partially developed. The option of a potential bi-directional energy exchange with the grid (“vehicle-to-grid” or V2G approach) for electric vehicles is fully developed. Electric vehicles are assumed to be flexible on charging side. Load is partially adapting to generation possibilities.

Vision 3 : “Green transition”

Economic and market

The general framework of this Vision 3 “Green transition” is that the economic and financial conditions are more favorable than in Visions 1 and 2 and as a consequence national governments have money to reinforce existing energy policies. However, the absence of a strong European framework is a barrier to the introduction of fundamental new market designs that fully benefit from R&D developments. Furthermore the opting for parallel national schemes regarding R&D expenses also result in a situation where major technological breakthroughs are less likely due to suboptimal and repeated R&D spending. Since there is a reinforcing of existing energy policies carbon pricing (e.g. the EU Emissions Trading System, carbon taxes or carbon price floors) reaches such levels that baseload electricity production based on gas is preferred to hard coal. Carbon and primary energy prices will be based on the 450 scenario of the IEA in their WEO 2011. Gas is likely to push out hard coal for baseload electricity generation. This means that countries with a lot of gas in their energy portfolio are likely to be net exporters.

Demand

Efforts in energy efficiency developments (e.g. large scale deployment of micro-cogeneration or heat pumps as well as minimum requirements for new appliances and new buildings) and the development of the usage of electricity for transport (e.g. large scale introduction of electric plug-in vehicles) and heating/cooling are intensified to minimize the ecological footprint. However these are developed in the current market frameworks. As a consequence electricity demand is expected to grow at a higher pace than in Vision 1 “Slow progress” and Vision 2 “Money rules” due to the fact that the introduction of these new uses of electricity outweighs any energy efficiency improvements and is intensified through additional subsidies. Furthermore the demand response potential is partially used to shift the daily load in response to the available supply, because it allows a saving on back-up capacity and it is cheaper than storage.

Generation

The future generation mix is determined by parallel national policy schemes that are on track to realize the decarbonisation objectives for 2050. But it will be at a higher cost than it would be the case with a strong European framework, since more back-up capacity is needed. The need for back-up capacity for intermittent renewables in Europe could be 5 times more than the back up capacity needed for the realization of 3x20 objectives. This means that although demand response potential is used (50% due to no fundamental change in market design) the majority of the additional back up capacity in 2030 would come from gas units since additional ways of central hydro storage are not developed due to lack of a strong European framework. This vision also takes into account the growing public opposition to nuclear power, although it is a low-carbon technology, influenced by the aftermath of the Fukushima Daiichi nuclear disaster. Although the vision permits deviations if this is in line with current national view, it is assumed in general that the financial community maintains its refusal to invest in nuclear technology on a merchant basis and that technology-specific support schemes are not likely. The absence of a strong European framework results in the assumption that commercial deployment of CCS infrastructure beyond the planned demonstration plants is not realistic.

Grid

Distribution grid and transmission system connected as today. There is a certain amount of price elastic demand and smart communication enabling distributed resources to balance the RES fluctuation. However it is assumed that this does not fundamentally change the height of the daily peak. The impact of electric vehicles is an augmentation of the load during off-peak hours.

Vision 4 : “Green revolution”

Economic and market

The general framework of this Vision 4 “Green revolution” is that the economic and financial conditions are more favorable than in Visions 1 and 2 and as a consequence national governments have money to reinforce existing energy policies. Major investments in sustainable energy generation are undertaken. Furthermore, a strong European framework makes the introduction of fundamental new market designs that fully benefit from R&D developments more likely. This also allows R&D expenses to be optimized so that major technological breakthroughs are more likely.

Since there is a reinforcing of existing energy policies carbon pricing (e.g. the EU Emissions Trading System, carbon taxes or carbon price floors) reaches such levels that baseload electricity production based on gas is preferred to hard coal. Carbon and primary energy prices will be based on the 450 scenario of the IEA in their WEO 2011. Gas is likely to push out hard coal for baseload electricity generation. This means that countries with a lot of gas in their energy portfolio are likely to be net exporters.

Demand

Efforts in energy efficiency developments (e.g. large scale deployment of micro-cogeneration or heat pumps as well as minimum requirements for new appliances and new buildings) and the developments of the usage of electricity for transport (e.g. large scale introduction of electric plug-in vehicles) and heating/cooling are intensified. Furthermore market designs are adapted in such a way that the highest energy savings are combined with the highest substitution to electricity. As a consequence electricity demand is expected to grow at the same pace as in Vision 3 “Green energy” due to the fact that the introduction of these new uses of electricity outweighs any energy efficiency improvements and is intensified through additional subsidies. Furthermore the demand response potential is fully used to shift the daily load in response to the available supply, because it allows a saving on back-up capacity and it is cheaper than storage.

Generation

The future generation mix is determined by a strong European vision that is on track to realize the decarbonisation objectives for 2050 at least cost. The need for back-up capacity for intermittent renewables in Europe could be 5 times more than the back up capacity needed for the realization of 3x20 objectives. However since there is a European common energy framework the need for back-up capacity will be lower than in Vision 3 “Green transition”. This means that besides the demand response potential that is fully used, central additional hydro storage is built in Norway, the Alps and the Pyrenees and the remaining additional back up capacity in 2030 will come from gas units. This vision takes into account that no technology is preferred and that they compete with each other on a market basis with no specific support measure. Furthermore decarbonisation is only driven by carbon pricing (no additional policies on top of carbon pricing are assumed) and assuming public acceptance of nuclear. The European subsidies for CCS to develop beyond demonstration are intensified in order to speed up to successful commercial deployment.

Grid

Distribution grids and transmission systems connected by an advanced monitoring, control and communication link. Distribution grids become active [by-directional electricity flows]. That configuration allows increased reliability, efficient management of peak demand, reduces required back-up generation capacity, increases environmental sustainability, reduces CO2 emissions, fully accomplishing requirements of the Roadmap 2050 milestones. The option of a potential bi-directional energy exchange with the grid (“vehicle-to-grid” or V2G approach) for electric vehicles is fully developed. Electric vehicles are assumed to be flexible on charging and generation side. Load is adapting to generation possibilities.

