Vision2030

Addendum

Process information availability and distribution

TenneT
Taking power further


2008
2009

Foreword

This document, Vision2030, presents a long-term vision with regard to the availability and distribution of process information derived from the stations and the electricity system (the Dutch electricity network). TenneT needs such information in order to fulfil its statutory responsibility for the transmission of electricity in the Netherlands, and to ensure full transparency in its interaction with external parties.

TenneT is constantly working to ensure a reliable high-voltage grid which is 'fit for purpose'. To meet the requirements of Dutch society, every two years we publish a 'Quality and Capacity Plan'. This plan covers a period of seven years and sets out any modifications we must make in order to safeguard the continuity of the electricity supply. The plan also provides a basis for any expansion in the medium-to-long term.

TenneT has also produced a Vision2030[1)] which considers the longer term. Given the increasing importance of information flows, it now becomes appropriate to supplement this document with the current addendum.

[1] Vision2030, TenneT, February 2008.
Vision2030, Addendum, TenneT, May 2010.

Vision2030

Process information availability and distribution

01 Introduction

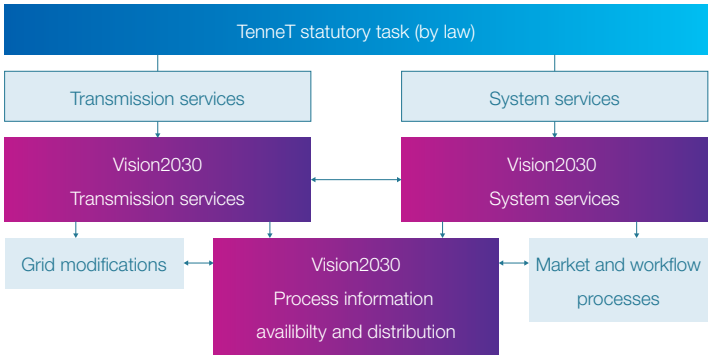
TenneT has two key statutory tasks. First, we must provide energy transmission services: TenneT is required by law to facilitate the transmission of electricity. In addition, we must provide system services. In both areas, it is useful to have a clear vision of the likely developments in the medium and long terms. Accordingly, we have decided to examine the developments which may be expected during the coming twenty years. In other words, we wish to form an impression of the possible situation in the year 2030.

This report distinguishes between three types of development:

- developments which affect the provision of transmission services
- developments which affect the provision of system services
- developments which relate to the availability and distribution of process information.

A previous report, Grid Vision2030 (published in 2008) examined the developments likely to affect the transmission services. A report on the developments affecting system services is forthcoming. In both cases, it is very important to identify the implications in terms of information flows and the data which must be made available to both internal and external parties. This is the topic of the current report, which therefore completes the series of three vision documents.

The purpose of the three reports in combination is to establish a 'dot on the horizon', thus enabling TenneT and the relevant stakeholders to make clear and informed decisions.



Why is this document important?

By devoting due thought to future developments and societal trends, TenneT will become better equipped to make the right choices. We shall then be able to continue performing our statutory tasks – the transmission of electricity and the provision of system services – in a satisfactory manner.

In this context, the questions to be addressed include:

- Who will require information from the stations in future, and what type(s) of information will they need?
- What information will be required to ensure the continuity of transmission and system services?

Considering future developments also helps TenneT to maximize the effectiveness of its capital investments in information systems. We shall be able to make more efficient use of our assets, and can offer greater transparency to all external stakeholders. There will be more opportunity for innovation. Last but not least, it will be possible to take future developments into account in topical projects, whereupon TenneT can undertake a phased upgrading of its information systems to arrive at the desired situation in 2030.

Target readership

This report has been produced for both internal and external use. It is in the public domain and accessible to everyone who is involved or interested in the energy chain.

02 Trends

This chapter outlines the trends which can influence future information requirements. Such trends can be technical, social or economic in nature, and most if not all will evolve independently of any decisions made by TenneT.

In other words, the trends and potential developments described below are external factors. They are largely outside TenneT's own sphere of influence but must nevertheless be taken into account when making decisions. Where appropriate, we must keep our options open.

We can identify the following relevant trends

1 **A greater volume of data will be available**
This can have a major influence on TenneT's decisions and activities. For example, readily accessible data about wind energy yield will enable TenneT to anticipate the demand for network capacity, and hence use the grid more efficiently.

2 **Electricity consumption will continue to increase**
Economic growth and the increase in electricity consumption generally run in parallel. There is no reason to suppose that this will not be the case in future.

3 **More fluctuations in electricity production and consumption levels**
A social development such as the large-scale adoption of electric transport will cause even greater fluctuations in demand for electricity. Similarly, an increase in the number of wind farms will create greater fluctuations on the supply side or, to be more accurate, more fluctuations in the way in which electricity is generated. As a result, the fuel mix[1)] will change more quickly and to a more significant degree.

4 **More fluctuations in the transmission requirement**
Factors such as an increase in large-scale wind and solar energy generation will cause greater fluctuations in the transmission capacity requirement.

5 **The emergence of a 'claims culture'**
The public is becoming ever more vocal in expressing its dissatisfaction when expectations are not met. If TenneT is to provide an adequate response to (legal) claims following supply outages or suchlike, we must record information about the essential business processes with all due diligence. TenneT wishes to be – and to be seen as – a fully transparent, well-regulated and accountable party.

[1] Mix of fuel types used to produce electricity.

6 Society, government/parliament and market parties will have a greater demand for advance process information
The public expects to be fully informed and to receive information at the earliest possible moment. This calls for a proactive communications strategy which places the interests of customers and other stakeholders to the fore.

7 More intelligence at a lower level
In many cases, data can be processed directly 'at source'.

8 The transmission grid will continue to exist
This is true even if there is a major transition to sustainable energy, since this too must be transported from source to user. Moreover. the transmission grid has a back-up function if there is any disruption to the supply of locally generated sustainable energy.

9 Data will increasingly be modelled, structured and categorized
This will facilitate the exchange of information throughout the chain, whereby its form and content can be better matched to the requirements of the intended users.

10 Data will become entirely independent of the transmission medium
It will make absolutely no difference if data is transmitted by wireless connection, via (optical) cable or any other means. Bandwidth restrictions will no longer be relevant.

11 Information will have greater economic value

12 Increased risk of sabotage and cybercriminality

13 Knowing rather than predicting
The availability of ever greater amounts of data will facilitate accurate forecasting and will enable a 'close to real time' response.

14 Greater dependence on reliable information
The adverse impact of inaccurate data will increase, and hence so will the importance of having good, reliable data available.

15 Work will go to the people
Staff will increasingly work independently of time and location further to the trend of 'new working practices' based on the use of IT. The most obvious example would be office staff, but in future it will also be possible to read the data at stations remotely. This imposes new demands in terms of network security.

16 More private grids
Many sites, such as business parks, will have their own electricity supply systems or 'private grids'.

17 Cost control will become more important
TenneT must use the existing grids more efficiently and effectively.

18 Greater requirement for ongoing staff training
While a screwdriver used to be enough for many jobs, staff will increasingly be expected to acquire an in-depth knowledge of informationsystems.

19 More rapid availability of information
Implementation of new information needs goes fast and flexible whereas the chosen architecture is supporting this. An example is new metering spots for billing.

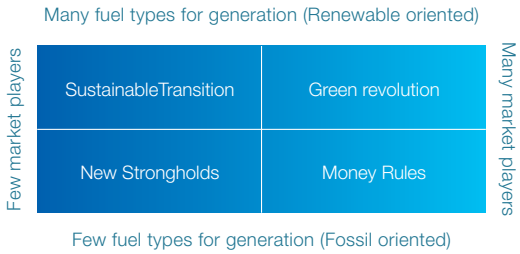
03

Uncertainties and scenarios

There are various future developments which may, and in some cases undoubtedly will, have an influence on the way in which TenneT fulfils its responsibilities. Two variables are likely to have such a major influence that we have used them to formulate four alternative future scenarios. Those variables are the organization of the sector itself and the 'fuel mix'.

- How will the electricity supply system be organized in the future? Will there be many players or relatively few (as in the current situation)? Will there be just a handful of very large producers, or will there be many producers of all sizes?
- Will the production of electricity continue to rely chiefly on fossil fuels, or will there be a significant increase in the proportion of energy derived from renewable sources? If there is a transition, how rapid will it be?

These two variables, when combined in various ways, reveal four alternative scenarios.



In the first, which we term the 'Green Revolution', there will be a significant decline in the importance of fossil fuels and an equally significant increase in the number of (small-scale) producers.

The second scenario, 'Sustainable Transition', also sees a major reduction in the use of fossil fuels. However, the number of energy producers remains limited. The 'New Strongholds' scenario assumes that the current situation, with its high reliance on fossil fuels and relatively few producers, will continue virtually unaltered. Finally, the 'Money Rules' scenario foresees an increase in the number of market players but little or no change to the fuel mix.

The four scenarios can help to reveal what is likely to happen if and when certain developments emerge.

It is important to remember that TenneT cannot opt for a certain scenario: the developments at any given moment dictate which scenario will be dominant. TenneT cannot, for example, dictate that there is to be greater or lesser use of green energy.

The following pages present summaries of the four scenarios, each beginning with an indication of the relative importance of the various stakeholders, as assessed by a team of both internal and external experts. The ranking relies on symbols, whereby '++' indicates a major importance and '-' indicates a secondary or lesser importance. Each summary also states which of the trends outlined above will play a part in the scenario concerned and to what degree. In the Green Revolution scenario, for example, it is reasonable to assume that an increase in demand and consumption will have less impact on the information architecture than in the Money Rules scenario. The summaries conclude with a consideration of the main uncertainties.

Scenario 1 - Green Revolution

This scenario is characterized by two key features: a large number of producers (market parties), many of who will be relatively small in scale, and the transition to (greater) use of renewable energy.

Stakeholder ranking

In this scenario, the relative importance of the stakeholders is:

++ Producers
++ Transmission
++ Distribution
++ Interconnectors
++ Service providers
+ Society
+ Consumers/customers
+ Other market parties
+/- Government and parliament

Main trends

In the Green Revolution scenario, an increasing volume of data will be available. There will be more fluctuations in the electricity transmission system. Society, government/parliament and market parties will have a greater demand for advance process information. There will be more intelligence at a lower level, whereby it will often be possible for data to be processed directly 'at source'.

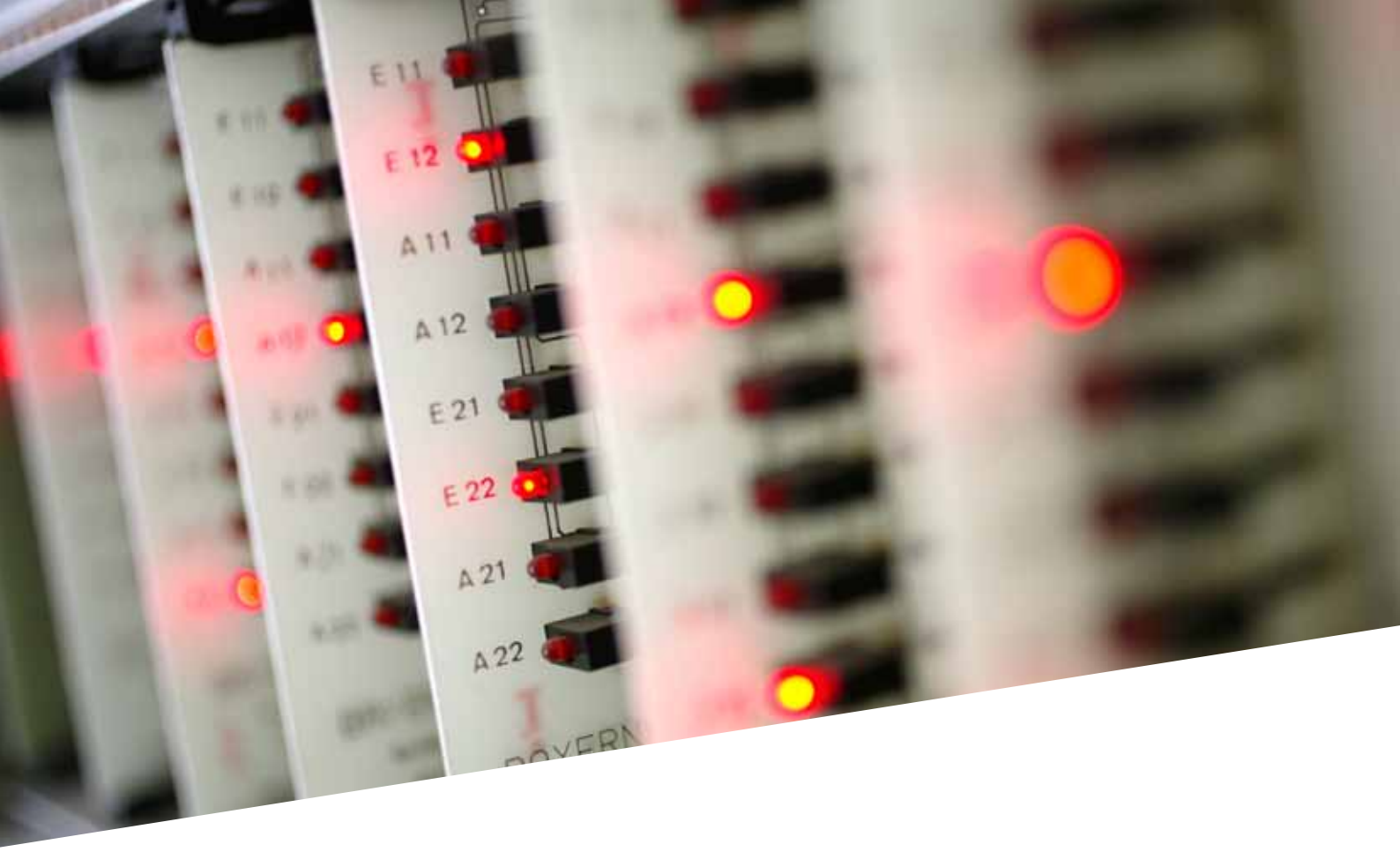
Data will increasingly be modelled, structured and categorized, while it will also be entirely independent of physical media (layered architecture).

This scenario also entails a greater economic value for data, with 'knowing' taking the place of 'predicting'. The information required to ensure effective management and commercial operations will be automatically generated. Information will be more crucial and must therefore be better secured (authorized users). The information will also be available more quickly. Work will increasingly move to the people. There will be more private grids. Finally, this scenario entails various changes in terms of organization, processes and personnel.

Main uncertainties

- At which grid level (low voltage, medium voltage or intermediate voltage[1]) will the greatest dynamic be seen?
- The political climate
- The economic situation (investment climate)
- How can new technology be incorporated into the installed base?
- Who is the owner of the telecom infrastructure/ assets?
- User requirements and preferences.

[1] See Figure 1 in the Summary of Vision2030: A perspective on the future of the national electricity transmission grid.



Scenario 2 - Sustainable Transition

This scenario is marked by a combination of a small number of large producers (as is currently the case) and a transition to greater use of more sustainable energy sources.

Stakeholder ranking

In the Sustainable Transition scenario, the relative importance of the stakeholders is:

++ Government and parliament
+ Producers
+ Transmission
+ Distribution
+ Interconnectors
+ Service providers
+ Society
+/- Consumers/customers
+/- Other market parties

Main trends

In this scenario, we may expect more fluctuations in the electricity transmission requirement. Clearly, the transmission grid will continue to exist. There will be a greater risk of sabotage and cybercriminality, while information required to ensure effective management and commercial operations will be automatically generated. There is also likely to be a greater dependence on reliable information.

Main uncertainties

- At which grid level (low voltage, medium voltage, intermediate voltage) will the greatest dynamic be seen?
- What will be the required transmission capacity on low voltage, medium voltage and intermediate voltage levels?
- Distribution of functionalities (Station NL-EU; scalability)
- Political climate
- Economic situation (investment climate)
- Sale of energy information
- Speed of technological innovation
- What information should/must the public be given?
- TenneT as information broker
- User requirements and preferences.

Scenario 3 - New Strongholds

In this scenario we see a limited number of large producers and continued reliance on fossil fuels. In fact, the scenario is a continuation of the current situation without any significant changes.

Stakeholder ranking

The relative importance of the various stakeholders in the New Strongholds scenario is:

+ Government and parliament
+/- Society
+/- Consumers/customers
+/- Other market parties
- Producers
- Transmission
- Distribution
- Interconnectors
- Service providers

Main trends

This scenario is based in part on increased consumption of electricity. Another important aspect is the emergence of a 'claims culture'. The transmission grid will continue to exist. There will be a higher risk of sabotage and cybercriminality. Cost control will become ever more important, whereupon TenneT must use the existing grid infrastructure more efficiently.

Main uncertainties

- Political climate
- What information should/must the public be given?
- TenneT as information broker.

Scenario 4 - Money Rules

In this scenario, there will be a far greater number of producers (many relatively small) and hence many more market players. The emphasis will remain on the use of fossil fuels.

Stakeholder ranking

The relative importance of the various stakeholders in the Money Rules scenario is:

+ Consumers/customers
+ Other market parties
+/- Producers
+/- Transmission
+/- Distribution
+/- Interconnectors
+/- Service providers
+/- Society
- Government and parliament

Main trends

In the Money Rules scenario, the consumption of electricity will continue to increase. At the same time, there will be more fluctuations in transmission. The scenario also foresees the emergence of a 'claims culture'. The transmission grid will continue to exist in its current form. Work will move to the people, and cost control will become increasingly important. TenneT must therefore use the existing grid infrastructure more efficiently. There will be a greater requirement for ongoing staff training.

Main uncertainties

- What information should/must the public be given?
- Fuel mix (fossil / wind / solar / nuclear)
- Distribution of functionalities (Station NL-EU; scalability)
- Political climate
- Sector organization (number of grid operators, producers, PRPs, aggregators, traders)
- Sale of energy information
- Speed of technological innovation
- How can new technology be incorporated into existing installations?

Relative importance of the trends in the various scenarios

The table below shows the relative importance of the trends in each of the four scenarios.

Relative importance of the trends in the various scenarios

	Trend	Green Revolution	Sustainable Transition	New Strongholds	Money Rules
1	Generation of more data	++	+/-	-	+
2	Increase in electricity consumption	2%	1%	0%	3%
3	Increase in grid fluctuations	++	++	-	+/-
4	More transmission and more fluctuations in transmissions	-	++	+/-	++
5	Emergence of 'claims culture'	-	+/-	++	++
6	Greater demand for information	++	+	+/-	+
7	More intelligence at a lower level	++	+	-	+
8	Transmission grid continues to exist	+/-	++	++	++
9	Data increasingly modelled and structured	++	+	+	+
10	Data becomes independent of physical media	++	+	+/-	+
11	Information has greater economic value	++	+	+/-	+
12	Increased risk of sabotage/cybercrime	+/-	++	++	+
13	Predicting becomes equivalent to knowing	++	++	+/-	+
14	Information becomes available automatically	++	++	-	+/-
15	Greater dependence on data	++	++	+	+
16	Authorized access to data	++	+	+/-	+
17	Work goes to the people in 2030	++	+/-	+/-	++
18	Emergence of private grids	++	+	-	+/-
19	Grids utilized more efficiently in 2030	+	+	++	++
20	Changes to organizations, processes and staff	++	+/-	+/-	++
21	New information implemented more rapidly	++	+	+/-	+

++ very important
+ important
+/- average
- less important

04

Using preconditions as design criteria

Careful analysis of the four scenarios reveals a number of general preconditions which apply in each case and which must be satisfied by 2030 if TenneT is to be fully prepared for the future situation. We are therefore able to list twelve preconditions which serve as a 'robust' set of design criteria and apply to all information systems to be acquired, for instance to access and distribute process information derived from the 110 to 380 kV substations.

The preconditions apply to all scenarios but in varying degrees of importance, as discussed below.

1 Security at various levels
Reliance on data will increase, and with it the importance of effective data security. Remote access must be possible, but only for authorized users. All access must be monitored and recorded. Effective security entails the ability to see exactly what is happening on the network at any given moment. The data transmission channels must also be secured by various means, e.g. encryption.

2 Stringent quality requirements for data
- an accurate and synchronized timestamp (verifiable, historic)
- this will enable an adequate response to any compensation claims
- synchronization of data will be made necessary by the increasing dynamic on the grid
- clear agreements with regard to ownership of data, partly in the interests of accuracy and reliability.

3 'Plug and play'
Because the implementation time of new data is becoming ever shorter, a 'plug and play' concept is desirable. It should be possible to interconnect all existing and future systems quickly and easily. Rapid implementation also calls for downtime (during installation or subsequent modifications) to be minimized.

4 Local pre-processing
Intelligence at lower levels enables local pre-processing, e.g. data reduction and filtering. Increasingly, the basic principle will be 'anything that can be processed locally should be processed locally'.

5 Infrastructure capable of carrying bidirectional traffic
The infrastructure must allow information to be derived from the customer, but must also offer the ability to send information to the customer.

6 Standardized data interfaces
- according to protocol
- according to communication information
- downwards compatible
- at station level
- at the level of individual components
- with clear (user) interfaces
- with standard object models for e.g. stations

7 Knowledge and experience within the organization to be available in digital form
This can be achieved through e-learning programmes, 3D techniques, applied gaming, simulations, etc.

8 More efficient use of assets
There must be more information about the condition and utilization of assets. TenneT must be accountable and fully transparent.

9 Further standardization of data
Standardization is required in order to make data fully independent of the physical media, preferably throughout the chain.

10 Distribution of process information to any location
Access to data must be reliable and independent of location.

11 TenneT systems must be able to meet new requests for (different types of) data
One way in which this can be achieved is to opt for an open architecture.

12 Real-time and on-demand information
Further to precondition 5 (above), the increased dynamic at all grid levels will result in greater demand for real-time and on-demand information.

Main features of each scenario

Sustainable Transition
In this scenario, the prime considerations are the quality of data and the bidirectionality of the data flows.

New Strongholds
Here, the emphasis is on the relevant information which is required to ensure efficient utilization of the grid. The ability to exchange information between grid levels is less important (as in the current situation).

Green Revolution
This scenario is notable for significant dynamic resulting in a requirement for the information provision to be as flexible as possible. All preconditions are therefore of equal importance.

Money Rules
In this scenario, bidirectional data exchange is not a priority. The ability to utilize the grids more effectively and the ready availability of process information are key considerations.

05 Concluding remarks

This report examines how TenneT needs to structure its information systems in the coming twenty years. The way forward obviously depends on all kinds of developments in society and technology. To create a degree of clarity despite these unknowns, we have grouped the likely developments into four scenarios. They are called Green Revolution, Sustainable Transition, New Strongholds and Money Rules. Each scenario has a different impact on how the company's information systems must be structured in 2030. Green Revolution will have the greatest impact, New Strongholds the least.

The Green Revolution scenario will see considerable interaction between the grids, parties and components that make up the energy supply chain. This is because of the increasing number of local electricity generators and the growing awareness among consumers. If 50% of all Dutch electricity consumers start to generate their own electricity locally, for example, there will be more than five million components and systems that will have to exchange information with each other. This will be possible only by using more local pre-processing. Even more than at present, the information network will remain an inseparable part of the electricity grid.

Data supply and demand will grow in all scenarios. Moreover, the data will have to be of high quality. As the reliance on data is becoming ever-greater, TenneT needs systems that can supply the required data and adjust quickly to changes in the nature and composition of the data. In all scenarios, security at all levels will be an important item. While data must be available at any arbitrary place, it must be viewable only by the parties for whom it is intended. As a result of an increasing exchange of information across the entire energy supply chain, the interfaces established between parties through far-reaching data standardisation will be crucial, as will the disconnect between data and physical communication media. This will make it easier to achieve a good match between information supply and demand within TenneT and also between TenneT and its business environment. By having data available in a standardised form in an open architecture, it will be possible to supply data to future users without radical technical modifications. The ability to respond rapidly to new needs and to process a new offering of data will become commonplace.

This report sets out a framework for TenneT's information management in 2030. It is a framework that will be suitable for every scenario without the need for radical redesign or restructuring. The company can move towards this situation step-by-step in the coming years by applying the design criteria to its investments in information systems. For reasons including TenneT's central role in the supply of energy, it is important to be transparent so that other parties know the direction in which TenneT is moving with its information systems.

The defined design criteria form a robust set of preconditions that will be important in all of the scenarios. Depending on future developments (i.e. which scenario will become the most dominant), one or more of the design criteria will play a significant role in structuring TenneT's information systems.

That is one of the reasons why it is important to evaluate periodically which of the four scenarios comes closest to the real-life situation and to identify any changes in trends. This will enable TenneT to make promptly any adjustments that are needed so as to align its information systems more closely with what lies ahead.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TenneT is Europe's first cross-border grid operator for electricity. With approximately 20,000 kilometres of (extra) high voltage lines and 36 million end users in the Netherlands and Germany we rank among the top five grid operators in Europe. Our focus is to develop a Northwest European energy market and to integrate renewable energy.

Taking power further

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