DELIBERATION NO 2018-072

Deliberation by the French Energy Regulatory Commission of 22 March 2018 on the examination of the 10-year development plans of GRTgaz and TIGF

Present: Jean-François CARENCO, president, Christine CHAUVET, Hélène GASSIN, Catherine EDWIGE, Hélène GASSIN, Jean-Laurent LASTELLE and Jean-Pierre SOTURA, commissioners.

Translated from the French: only the original in French is authentic

LEGAL FRAMEWORK

Article 8 §3.(b) of Regulation (EC) No. 715/2009[1] specifies that the European Network of Transmission System Operators for Gas (hereinafter ENTSOG) shall adopt, every two years, a non-binding ten-year European network development plan (hereinafter TYNDP), after open and transparent consultation with all market participants. The Agency for the Cooperation of European Regulators (ACER) issues an opinion on that plan and monitors its implementation.

Article L.431-6, I of the French energy code states that transmission system operators (TSOs) shall draft, after consultation of interested parties, a ten-year development plan for their networks (hereinafter 10-year plan), based on:

- existing gas supply and demand;
- reasonable medium-term projections of the development of gas infrastructure;
- reasonable medium-term gas consumption projections;
- reasonable medium-term projections of international exchanges;
- the assumptions and needs identified in the report on investment planning in the gas sector drawn up by the Energy Minister.

The plan specifies the main transmission infrastructure that must be built or upgraded over the next ten years, lists the investments already confirmed, identifies new investments to be made over the upcoming three years and provides a forecast schedule for all investment projects.

The 10-year plan is submitted each year for CRE's examination so that it may ensure, on the one hand, that all investment needs are covered, and on the other hand, that the plan submitted is in line with ENTSOG's network development plan. If there is any doubt on the last point, CRE may consult ACER.

CRE may also, if it considers that these requirements are not met, request the TSOs to modify their 10-year plans.

GRTgaz and TIGF submitted their draft 10-year plans to CRE in October 2017. CRE ran a public consultation on the TSOs' 10-year development plans from 16 November to 1 December 2017. Eight contributions were received: three from shippers, two from associations and three from infrastructure operators.

[1] Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005

1. BACKGROUND

1.1 Objectives of energy transition

The first multiannual energy programme[2], which sets the guidelines and actions for reaching the goals of the energy policy defined in Articles L. 100-1, L. 100-2 and L. 100-4 of the French energy code, was published on 28 October 2016. It defines in particular the following objectives in the gas sector: for primary gas consumption to drop between 9 and 16% in 2023 compared to 2012;

- for the portion of the natural gas heavy goods vehicle (NGVs) fleet to reach 3% in 2023 and 10% in 2030;
- to develop the supply of LNG (liquefied natural gas) marine fuel in ports, and LNG/NGV infrastructure for road fuel;
- for annual production of biomethane capacity injected into the network to reach over 8 TWh by 2023;
- to support the development of bioNGV to reach 0.7 TWh consumed in 2018 and 2 TWh in 2023, with a view to bioNGV representing 20% of NGV consumption in 2023, in segments complementary to those of electrical vehicles and rechargeable hybrid vehicles;
- to pursue and finalise L gas conversion assessments because of the termination of extraction at the Groningen gas field (the Netherlands) by the end of 2029. To also finalise a backup scenario in the event that early conversion becomes necessary if the operation of the Groningen field is terminated earlier than anticipated.

In addition, Article L.141-10 of the energy code, amended by the energy transition act specifies that "*natural gas transmission system operators establish at least every two years, under the State's supervision, a forward multi-annual estimate*. *This estimate takes into account developments in consumption, transmission, distribution, storage, regasification, renewable energy production and exchanges with foreign gas networks*."

1.2 ENTSOG's ten-year network development plan (TYNDP)

The role of the TYNDP was strengthened when it became likely for the projects it identifies to obtain the status of "projects of common interest" (PCIs), based on the cost/benefit assessment, the methodology of which is specified by regulation (EU) No. 347/2013[3]. These assessments also serve, as the case may be, to determine cross-border allocation of project costs based on that same regulation.

1.3 Consultation of participants

In accordance with the provisions of Article L.431-6 of the energy code, the TSOs are required to consult interested parties when drawing up their 10-year plan. To do so, the TSOs use several mechanisms:

- Concertation gaz set up for the French market since 2008;
- work carried out at European level within the framework of regional investment plans[4] and North West and South regional initiatives steered by European regulators;
- work conducted under the auspices of ENTSOG within the framework of the elaboration of European ten-year network development plans;
- bilateral exchanges, in particular with adjacent infrastructure operators;
- the evaluation of market demand for incremental capacity, as specified by the European network code on capacity allocation mechanisms[5].

These mechanisms serve, in particular, to detect the emergence of new needs, complementing network assessments and the demands of project promoters (industrial clients, adjacent infrastructure operators).

Evaluation of market demand for incremental capacity was therefore conducted for the first time by the TSOs in 2017[6]. The report presenting the results of this evaluation state that no participant expressed a demand for new capacity at the interconnection points between the French transmission network and neighbouring transmission networks.

1.3.1 Summary of the public consultation

[2] A new multiannual energy programme has been in preparation since end 2017

[3] Regulation (EU) no 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure

[4] GRIP: Gas regional investment plan

[5] Regulation (EU) No 2017/459 of the Commission of 16 March 2017 establishing a network code on capacity allocation mechanisms in gas transmission systems

[6] Demand assessment report for incremental capacity for France

Participants are globally satisfied with the different market consultation methods. However, they expressed their reservations about the consultation process for 10-year development plans:

- two participants were disappointed at not having been consulted by the TSOs during the year to discuss the assumptions used for drawing up gas demand scenarios;
- one participant considered that the deadline for contributions given by CRE for the public consultation (two weeks) was too short. Moreover, GRTgaz made its 10-year plan public on 29 November, i.e. the day before the end of the public consultation, and three participants regretted this late publication of the plan by GRT-gaz;
- two participants wondered about the exchanges that took place between the TSOs and adjacent operators, within the framework of the evaluation of capacity needs.

1.3.2 CRE's analysis

In its deliberations of 17 December 2015, CRE requested the TSOs to regularly provide an update of progress concerning the drafting of their 10-year plans within the framework of Concertation gaz meetings, without waiting for them to be finalised. In June 2016, the TSOs and the distribution system operators (DSOs) organised a consultation meeting for all market participants to present the assumptions of the forward estimate review published that same year.

In 2017, the TSOs carried out only an update of the forward estimate published in 2016. GRTgaz and TIGF presented their 2017-2026 10-year development plans within the framework of Concertation gaz on 24 October 2017.

CRE considers that a briefing within the framework of Concertation gaz earlier in the year would have served to inform market participants of the evolutions in gas demand and to gather their opinions on the evolution of scenarios. Therefore, CRE reiterates its request for information to market participants during the year so that a progress report could be presented on the assumptions and projects adopted in the TSOs' 10-year plans.

In addition, TIGF published its 10-year plan[7] on 27 October 2017 on its website. GRTgaz published its 10-year plan[8] only the day before the end of CRE's public consultation. Therefore, CRE requests that the TSOs make their 10-year plans public when they forward them to CRE.

2. DEMAND EVOLUTION SCENARIOS

2.1 Assumptions of natural gas consumption in France in TSOs' forward estimate

In compliance with Article L. 141-10 of the energy code, on 27 October 2016, GRDF, GRTgaz, SPEGNN[9] and TIGF published the first multiannual forward estimate presenting their projected evolutions in gas consumption and renewable gas production in France by 2035. This estimate is centred around three scenarios, A (reference scenario), B (proactive scenario) and C (low scenario). In 2017, certain assumptions in the forward estimate were updated[10], to take into account the actual change in gas consumption in 2016. Within the framework of the TSOs' 10-year plans, gas demand projections are presented for 2026. Projections are extended up to 2035 on an indicative basis.

[7] TIGF's 10-year plan
[8] GRTgaz's 10-year plan
[9] Professional association of non-nationalised gas companies
[10] 2017 multiannual forward estimate

	Scenario drivers	Scenario A (central)	Scenario B *(high scenario)*	Scenario C *(low scenario)*
Main factors	Demographics	Evolution of the number in the household		
	Economic growth	Moderate	Greater	Lower
	Energy efficiency	High	Greater	Lower
Secondary factors	*Building renovation*	High	Greater	Lower
	Development of renewables	High	High	Lower
	Substitutions	Moderate	High	Low
	Mobility gas	High	Very high	Low
	CO_2 constraints	High	Very high	Low

Source: forward estimate of regulated infrastructure operators 2016

Scenarios presented in operators' 2016 forward estimate

- Scenario A – central trajectory

Scenario A serves as a reference, with a selection of assumptions in compliance, according to the TSOs, with the probable evolution of the structural, economic and regulatory context.

It is based on a set of assumptions that aim at maintaining the current trend in renewable energy development and energy savings. This drop in overall gas consumption volume in France is mainly due to the reduction in unit consumption. The drop is partially offset by an increase in the use of gas in the residential and service sectors, as well as by the strengthened role of gas in industry and electricity production, because of its economic competitiveness and its environmental edge on coal and fuel - particularly regarding CO_2 and particle emissions. Scenario A considers that the support mechanisms for the acquisition of NGVs and for the development of NGV stations will contribute to the growth of the mobility sector.

- Scenario B - the high trajectory

Scenario B is the high trajectory. This scenario is part of a context where gas is highly available on the market, with a return of LNG to Europe and greater competition from gas. In particular, gas is increasingly used for electricity production. Its use is also growing in industry and for heating in the residential and service sectors. Fuel gas, moreover, is promoted, as well as the development of renewable gas production.

- Scenario C – low trajectory

This scenario is marked by the consequences of new environmental regulations aimed at reducing gas demand. The goal of a 30% reduction in fossil energy consumption compared to the 2012 level is applied uniformly to the use of gas, oil and coal with no regard for the better environmental performance of gas compared to oil and coal.

- A single trajectory for gas-fired electricity production

In 2016, the TSOs had used the assumptions of the "New mix" scenario of RTE's 2014 forward estimate to develop two alternatives (high and low alternatives).

Given the high gas demand in 2016 for power generation plants and cogeneration plants, operators revised the assumptions taken into account in the 2016 multiannual forward estimate. For the 2017-2026 10-year plans, they used the high trajectory updated to take into account actual 2016 figures.

GRTgaz therefore proposes a single trajectory with a high level of gas consumption for electricity production. For the 2017-2025 period, power plants have a generating capacity of 6.3 GWe and are supplemented in 2022 by the Landivisiau power plant. Power plants' gas demand is set at 40 TWh per year, supplemented by 30 TWh/year for cogeneration plants, i.e. a total of 70 TWh/year.

In the TIGF zone, the operator considers two alternative scenarios: one where gas-fired electricity production does not change during the period covered by the forward estimate review, in the absence of production facilities (scenarios A and C). In scenario B, TIGF envisions the commissioning of a plant in its zone in 2021 (+4 TWh/year).

2.1.1 The evolution of consumption in GRTgaz zones for 2026

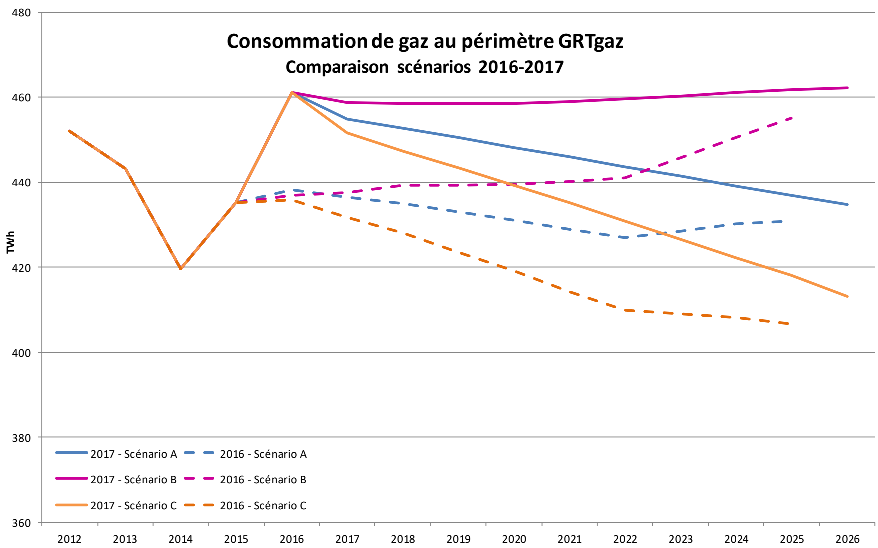
Consumption in GRTgaz's perimeter totalled 461 TWh in 2016, up 6% compared to the 2015 level. This increase is due in particular to gas-fired electricity production, which was high, related mostly to the simultaneous shutdown of several nuclear reactors.

On the basis of the scenarios of the forward estimate revised in 2017, GRTgaz presents the evolution of gas demand for 2026. According to the scenarios, total gas consumption across its perimeter varies from 462 TWh (high scenario) to 413 TWh (low scenario) in 2026.

Segment	Actual 2016	Projected (2026)		
		Scenario A	Scenario B	Scenario C
Residential	143.4	123.2	128.1	118.4
Tertiary	82.8	75.3	77.7	71.6
Industry	157.4	150.9	161.2	139.8
Electricity production	72.5	70.0	70.0	70.0
Mobility gas	1.0	10.9	20.5	9.2
Auto-consumption	4.0	4.4	4.7	4.2
Consumption	461.1	434.7	462.2	413.2
Annual evolution 2017/26	-	**-0.5 %**	**+0.1 %**	**-1.0%**

Source: GRTgaz, TIGF

GRTgaz forecasts a drop in consumption in two out of three scenarios. In the central scenario, GRTgaz forecasts a level of consumption of 435 TWh, down 5% compared to the actual level in 2016.



Since the work conducted in 2016, GRTgaz has revised its scenarios taking into account in particular the actual level of consumption in 2016, particularly gas-fired electricity production. Therefore, the point of arrival expected in 2026 is up compared to the exit point presented in the previous 10-year plan, with a convergence of values for 2035.

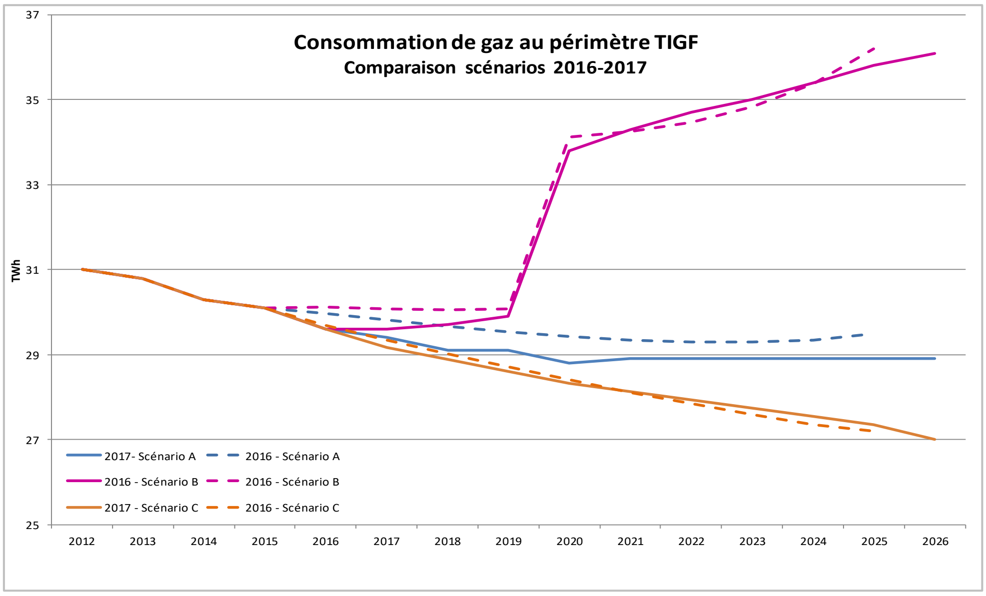
2.1.1 Evolution of consumption in the TIGF zone for 2026

On the basis of the forward estimate revised in 2017, TIGF estimated gas demand within its perimeter. Consumption in the TIGF zone totalled 29.6 TWh in 2016, down 1.7% compared to consumption in 2015.

Based on the scenarios in the forward estimate revised in 2017, TIGF presents the evolution of gas demand for 2026. According to the scenarios, total gas consumption in its perimeter varies from 36 TWh (high scenario) to 27 TWh (low scenario) in 2026.

Segment	Actual 2016	Projected (2026)		
		Scenario A	Scenario B	Scenario C
Residential	12.8	11.0	11.4	10.6
Tertiary	6.3	5.7	5.9	5.4
Industry	9.3	9.0	9.7	8.2
Electricity production	1.0	1.0	5.0	1.0
Mobility gas	0.2	2.2	4.1	1.8
Consumption 2016/2026	29.6	28.9	36.1	27.0
Annual evolution 2017/26	-	-0.2%	+1.3%	-1.0%

TIGF forecasts a drop in consumption in two out of three scenarios. Therefore, the consumption exit points expected in 2026 are slightly lower than the exit points presented in the previous 10-year plan.

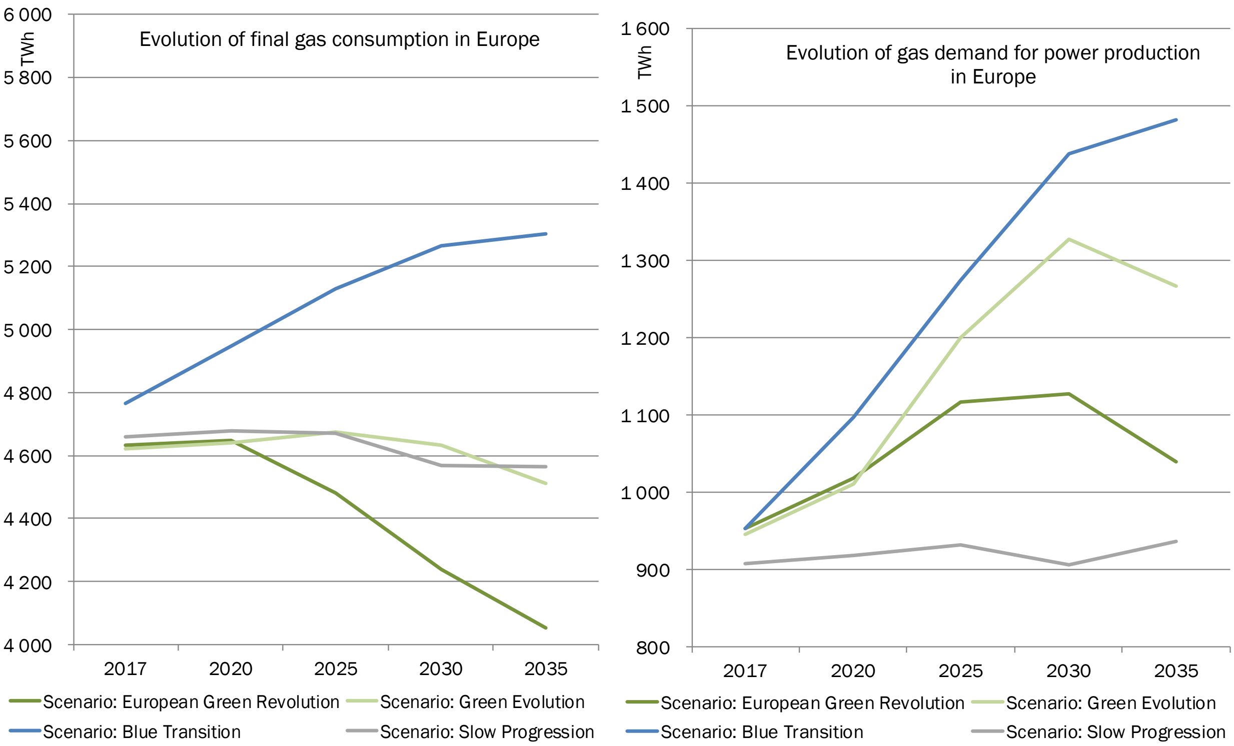


Since consumption in the TIGF zone was down in 2017 compared to 2016, comparison of the 10-year plans shows a small increase in the drop of consumption for 2026.

2.2 Natural gas consumption assumptions in Europe in ENTSOG's TYNDP

The 2017 TYNDP was published on 28 April 2017. For its preparation, the TSOs communicated their gas consumption and injection forecasts as well as the list of projects presented in their 2015 10-year plans. It was submitted for an opinion by the Agency for the Cooperation of Energy Regulators (ACER) on 15 March 2017[11]. Within the framework of the 2017 TYNDP, ENTSOG adopted four scenarios:

- the "slow progression" scenario, presents a stability in the current indicators and forecasts a 2% drop in final gas consumption. Gas demand for electricity production, estimated at 1,000 TWh in 2017 remains at the same level for 2035;
- the "blue transition" scenario forecasts a sharp increase in gas consumption, related in particular to the increased use of gas to the detriment of coal in electricity production and the development of NGV. It forecasts a 10% increase in consumption between 2017 and 2035, i.e. gas demand totalling 5,300 TWh, in comparison with the level estimated in 2017 at approximately 4,650 TWh. Gas demand for electricity production, estimated at 1,000 TWh in 2017 is expected to increase to 1,500 TWh for 2035;
- the scenario: "vision 4", comprising two alternatives "Green evolution" and "European green revolution". In these two scenarios, gas is in strong competition with electricity in the heating and mobility sectors. It forecasts a 12% drop in final gas consumption for 2035, with European gas consumption estimated at 4,000TWh.



Source: ENTSOG

Total gas demand in the scenarios of ENTSOG's 2017 network development plan

[11] ACER's opinion

2.3 Summary of the public consultation

2.3.1 Demand scenarios

Contributors are in favour of the assessment of several scenarios. However, one participant considers that the assumptions considered are not well-defended.

One participant observed that the scenarios proposed are in line with those of ENTSOG. However, another participant noted that the trajectories presented by the TSOs do not comply with the objectives set out in the multiannual energy programme and the national low carbon strategy. The energy transition for green growth act sets the objective of reducing primary fossil energy demand by 30% and the current multiannual energy programme defines a goal of reducing primary fossil gas demand by 8.4% in 2018 and 15.8% in 2023 compared to 2012.

Several participants consider that the annual consumption volume data presented by the TSOs should be supplemented by peak consumption data according to the different scenarios. These are in fact essential for dimensioning networks and clarifying whether or not investments are needed.

2.3.1 Electricity production trajectory

With regard to gas-fired electricity production, RTE had not yet updated its 2017 forward estimate when the 10-year plans were drafted. Therefore, the TSOs based their electricity production trajectory on the high alternative from the "New mix" scenario of RTE's 2014 forward estimate and on actual production in 2016.

One participant is in favour of taking into account a single scenario for this sector. However, an infrastructure operator considers that there could be a wider variation range in the scenarios.

Participants were not all in agreement as concerns the trajectory's point of departure. One participant considered that the reference scenario was too low, limiting consumption from now to 2035 at a level slightly lower than that in 2016 (46 TWh) and much below that observed in 2017 (55 TWh). However, another participant considered that 2016 consumption was high due to the existing conditions, particularly the unavailability of nuclear generation at the end of 2016. Therefore, the participant recommended using the 2015 level (21 TWh) for the gas consumption trajectory. Therefore, given the degree of uncertainty concerning consumption forecasts, a participant recommended an annual revision of this forward-looking exercise.

One participant regretted that the underlying assumptions of gas consumption for electricity production were not described in detail.

2.4 CRE's analysis

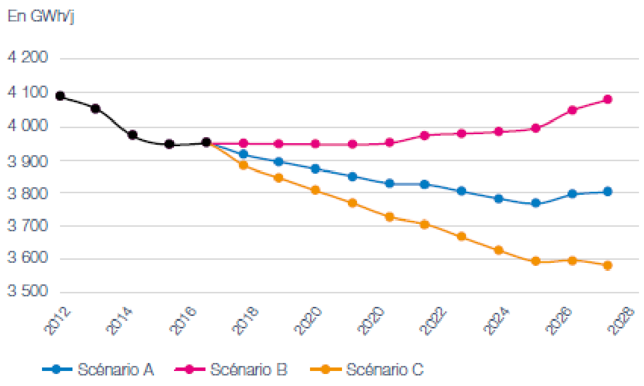
CRE notes, for the update of the forward estimate, that the TSOs and DSOs carried out a coordinated joint analysis regarding the development of the three scenarios for the multiannual forward estimate. It considers that the scenarios presented are in line with the TYNDP's scenarios. Indeed, the scenarios adopted by ENTSOG are based in particular on the scenarios of the French TSOs forwarded end 2015 within the framework of their 2015-2024 10-year plans. ENTSOG's "slow progression" and "blue transition" scenarios adopt the fundamentals of the TSOs' 2015 reference scenario, and the "*European Green Revolution*" and "*Green Evolution*" scenarios correspond to the "Minus 30" scenario. The "minus 30" scenario proposed in the TSOs' 2015-2024 10-year plans, implies uniform application of the 30% reduction goal to all fossil fuels. The main difference with the 2015 reference scenario is the greater reduction of gas consumption in the residential and service segments (-42% between 2012 and 2030 compared to -27% in the 2015 reference scenario).

CRE notes that the scenarios presented by the TSOs in their 2017-2026 10-year plans are not in line with the objectives of the multiannual energy programme. According to GRTgaz, for 2030, within the framework of the energy transition act, scenario A, the reference scenario, and scenario C, the low scenario, are close to the objective of 30% reduction in primary consumption of fossil energy by 2030 compared to 2012. However, reaching these goals depends on the achievement of an optimistic scenario of renewable gas injection. One contributor to the public consultation considers that it is essential to combine a scenario involving growth in gas demand with a major development in renewable gas production, at the risk of not complying with objectives of a reduction in CO_2 emissions and in consumption of imported fossil fuels.

CRE notes that the projected consumption trajectories presented by the TSOs are matched with projections of high renewable gas injection (see 3.1.1.).

CRE requests the TSOs to explain in detail in the next scenarios, and for each scenario, the assumptions underlying the achievement of the objectives of the energy transition act and of the multiannual energy programme and any possible deviations.

With regard to peak consumption scenarios, GRTgaz did in fact include them in its 10-year plan. Peak consumption is down an average 0.4% per year in the central scenario and stands at 3,723 GWh/d in winter 2026/2027. It ranges between 4,100 GWh/d, presenting an average annual increase of 0.3% in the high scenario and 3,600 GWh/d in the low scenario, i.e. an average annual drop of 0.9%. These scenarios are in line with the total gas consumption scenarios which show annual average variation rates between -1% and 0.1%.



Daily peak consumption within GRTgaz's perimeter

CRE agrees with the need to supplement the analysis of average consumption by peak consumption figures. Therefore, it requests GRTgaz to specify the assumptions for developing these peak scenarios, and TIGF to present its scenarios and underlying assumptions.

Moreover, with regard to the single scenario for electricity production, CRE considers it useful to maintain several scenarios, given the degree of uncertainty concerning use of this sector. It also considers it necessary for the TSOs to adopt scenarios in line with those of RTE's forward estimate. In its 2017 forward estimate, RTE studied several scenarios with different time horizons. An initial scenario, called "Ohm", explores the consequences of the implementation of the energy transition act up until 2025. RTE then develops four long-term scenarios (horizon 2035), called "Ampère", "Hertz", "Volt" and "Watt", which all have in common the systematic achievement of the 40% objective of electricity production using renewable energy.

All of the scenarios maintain gas-fired power plants as a basis. Regardless of the scenario envisaged, all existing or scheduled combined-cycle gas power plants (Landivisiau) are maintained. A combined-cycle gas plant is set to be commissioned at Landivisiau in 2021.

According to RTE, to comply with the objective set by law to reduce the portion of nuclear generation to 50% of production by 2025, a significant number of new gas plants must be build, corresponding to 11 GW of additional installed power, i.e. the equivalent of the capacity of the combined-cycle gas plants currently in operation. If coal plants are shut down, this additional installed power could reach 14 GW. RTE however highlights the uncertain profitability of gas power plants, given the development of renewable energy.

3. ASSUMPTIONS CONCERNING THE EVOLUTION OF RENEWABLE GAS INJECTION INTO THE NETWORKS

3.1 Assumptions concerning the evolution of renewable gas injection into the networks in the 10-year plans

In 2016, GRTgaz launched a SmartGrid programme, based on four axes:

- maximising insertion of renewable energy at the best cost;
- coupling gas and electricity networks;
- improving network efficiency;
- offering information to enable stakeholders to act more efficiently.

This programme was presented to CRE, within the framework of the GRTgaz 2020 business project during preparatory work related to the ATRT6 tariffs. TIGF also presented a research and innovation (R&I) programme, a part of which covers development of biogas.

3.1.1 Biomethane (from methanisation and pyrogasification)

In the previous 2015 and 2016 10-year development plans, the TSOs considered two biomethane production trajectories with an injection objective in 2030 of 12 TWh in a "business as usual" scenario, and 30 TWh in a proactive scenario. These two scenarios came from ADEME's roadmap published in 2014[12].

The TSOs, in their 2017-2026 10-year plans, used the assumptions adopted in the multiannual energy programme. That programme sets the goal of reaching a biomethane production capacity injected into the network of over 1.7 TWh as from 2018 and 8 TWh in 2023, i.e. 6 TWh within GRTgaz's perimeter and 2 TWh within that of TIGF. In addition, the energy transition act sets a goal of 10% renewable energy in gas consumption in France by 2030, i.e. 12 TWh at national level (9 TWh within GRTgaz's perimeter and 3 TWh within that of TIGF).

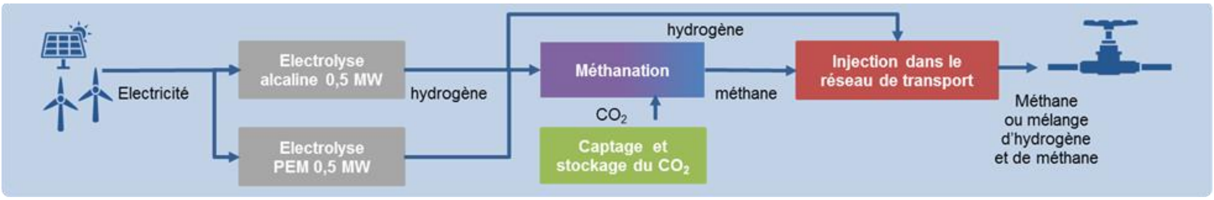
The operators also present a new development scenario, which now aims for 30% renewable gas in the energy mix by 2030, i.e. 90 TWh of green gas[13] injected into the networks, based on all accessible resources.

As at 31 December 2017, 44 biomethane sites were in operation in France, for a total injected volume of 407 GWh. Two of these injection sites have been directly connected to GRTgaz's and TIGF's transmission networks since 2015. Queued injection capacity totals over 7 TWh, distributed across 360 projects.

In 2017, TIGF signed three new connection contracts. In addition, in its 2017-2025 10-year plan, the operator forecasts the connection of one injection site each year until 2023, followed by the connection of two sites per year.

3.1.2 Power to gas

"Power to gas" consists in transforming electricity into gas, to enable electricity to be stored. The goal of this sector is to promote the insertion of intermittent energy, by facilitating balancing of electricity networks, and using the surplus electricity produced from renewable energy. The hydrogen produced during the electrolysis process can then be directly injected into the networks (in small quantities) or converted to synthetic methane (CH_4) through reforming with CO_2 (use after capture of CO_2 emissions from industrial, agricultural processes or electricity production), which can be injected into the gas networks. The synthetic methane produced is, by nature, a renewable gas.



Source: Multiannual forward estimate

Power to gas principle

Within the framework of their research and development programmes, RTE and GRTgaz signed a partnership in 2016 aimed at identifying and promoting coupling of gas and electricity. Under that partnership, operators committed in a power-to-gas project, to the Jupiter 1000 project, located in Fos-sur-mer, which should be operational in 2018.

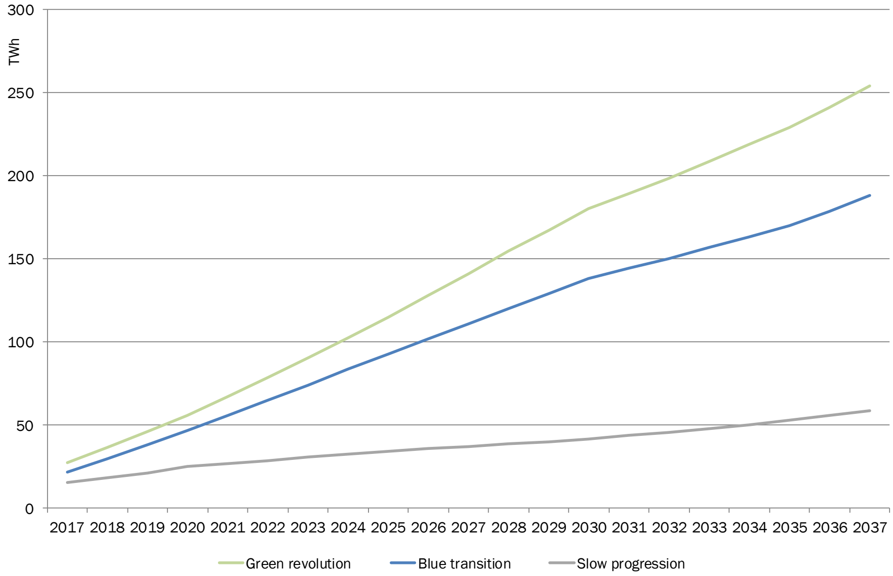
However, at this stage the TSOs do not anticipate any rapid development at industrial level of the sector before 2025. By 2030, GRTgaz estimates that roughly 100 power-to-gas installations could enable storage of 2.5 to 3 TWh of surplus renewable electricity.

[12] ADEME's roadmap
[13] Green gas refers to gas resulting from methanisation and gasification

3.2 Assumptions concerning the evolution of biomethane production in ENTSOG's network development plan

At European level, work carried out within the framework of the 2017 TYNDP[14] take into account an increase in biomethane injections by 2035 according to three scenarios:

- "slow progression" where the level could reach 53 TWh: in France, the biomethane injection level is estimated at 0.6 TWh;
- "blue transition" with an estimated level of 170 TWh: in France, biomethane injection is estimated at 12 TWh;
- "European green revolution" where the level could reach 229 TWh: in France, the biomethane injection level is estimated at 38 TWh.



Source: ENTSOG

Evolution of biomethane production

In the 2017 TYNDP, power to gas is not taken into account in the gas consumption scenarios. However, the 2018 TYNDP work, done in coordination with ENTSO-E[15], should take into account this source of gas.

3.3 Summary of the public consultation

3.3.1 Biomethane

With regard to the renewable gas injection scenario, most contributors expressed reservations about the 90 TWh objective, which appeared very optimistic in their opinion.

Contributors highlighted in particular the obstacles to the development of renewable gas. One contributor reiterated that the most recent projects had seen some difficulties with regard to commissioning. At the regulatory level, contributors expect an improvement in regulations concerning the guarantee of origin and an upgrading of incentive mechanisms for biomethane production.

In addition, certain participants reiterated that the scenario presented must be considered with caution so as to not trigger investments in networks that would become stranded costs.

3.3.2 Power to gas

Contributions to the public consultation cover in particular the Jupiter 1000 project. The summary is presented in the "DEVELOPMENT PROJECTS" section.

[14] 2017 TYNDP – biomethane injection projections
[15] European association of electricity transmission operators

3.4 CRE's analysis

3.4.1 Biomethane

ENTSOG's and the TSOs' plans highlight a major development of the biomethane sector, in line, for France, with the drive introduced by the energy transition act.

CRE notes that the data presented by ENTSOG for the 2017 TYNDP stem from the TSOs' 2015-2024 10-year plans, which are based on, for GRTgaz, ADEME's roadmap:

- the "blue transition" scenario corresponds to the trend assumption presented in ADEME's roadmap of 12 TWh injected in 2030, which includes 9 TWh for the GRTgaz network;
- the "European green revolution" scenario, corresponds to the proactive assumption presented in ADEME's roadmap of 30 TWh injected in 2030, which includes 22.5 TWh for the GRTgaz network.

In addition, the "European green revolution" and "Blue transition" scenarios presented by ENTSOG are in line with the objectives of the multiannual energy programme of 8 TWh injected into the networks by 2023.

With regard to the green gas injection assumptions presented in 2017, the TSOs propose a new trajectory of 90 TWh for 2030. This ambitious goal corresponds to 30% green gas injected into the networks, which is above the objectives of the energy transition act (10% renewable energy in final gas consumption). To develop this scenario, the TSOs take into account all of the potential inputs of green gas - 70 TWh from methanisation and 20 TWh from gasification.

CRE considers that the TSOs' central scenario is a very ambitious trajectory of biomethane development. It requests the TSOs to examine different biomethane development scenarios and analyse their consequences in terms of network development costs.

In addition, the different possible outlets for methanisation (injection, cogeneration, gas transported) must be analysed compared to their costs and benefits for the community. The benefits of direct injection into the natural gas networks are clear in terms of energy efficiency but this is not systematically relevant in the zones furthest away from the network.

3.4.2 Power to gas

CRE observes that the TSOs have made power to gas a major green gas development axis for 2030, particularly to enable storage of intermittent energy production. However, it notes that at this stage, they do not anticipate any commercial development before 2026.

4. DEVELOPMENT PROJECTS IDENTIFIED BY THE TSOs IN THE 10-YEAR PLANS

4.1 No development in the transmission capacity offering in 2017

The most recent transmission capacity development projects were commissioned in 2016:

- in the GRTgaz network, connection of the Dunkirk LNG terminal: the infrastructure related to the connection of the Dunkirk terminal was commissioned in December 2015. The terminal began commercial operations in autumn 2016.
- in the GRTgaz network, the Arc de Dierrey project[16], approved by CRE in its deliberation of 22 December 2011 was commissioned in 2016. This project is needed for debottlenecking the North-South link and creating a single marketplace by 2018;

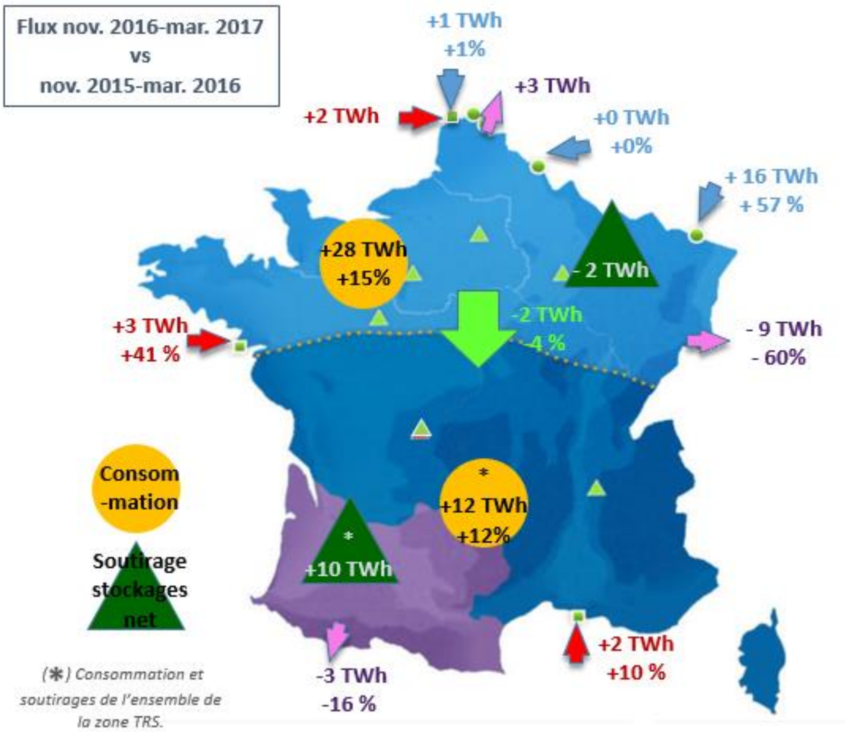
End 2016, firm entry capacity in France totalled 3,585 GWh/d, up more than 50% compared to 2005, and is shared between entry capacity from adjacent networks and entry capacity from LNG terminals.

End 2016, firm exit capacity totalled 658 GWh/d, up 116% compared to 2005.

[16] This project is included in the list of "projects of common interest" adopted by the European Commission on 14 October 2013 for the 2014-2016 period.

GWh/d	2005	2016	2005-2016 evolution
Firm entry capacity	**2,345**	**3,585**	**+52%**
Of which pipeline	1,805	2,285	+27%
Of which LNG	540	1,300	+141%
Firm exit capacity	**304**	**658**	**+116%**

No major project was commissioned in 2017. Work is currently in progress to enable the commissioning of several investment projects in 2018, particularly in view of the merging of zones.



Source: GRTgaz, TIGF

Evolution of flows between 2015/2016 and 2016/2017 winters

4.2 Developments expected in 2018

4.2.1 The single marketplace in France

In its deliberation dated 7 May 2014[17], CRE adopted the schema associating the Val de Saône project, on GRTgaz's network, and the Gascogne-Midi project, on the GRTgaz and TIGF networks, to enable the creation of a single marketplace in France by 2018. In its deliberation dated 30 October 2014[18], it defined the target budgets for these projects (€650 M and €152 M respectively) and determined the parameters of incentive regulation applicable to them. These two projects were adopted as projects of common interest in the list established on 18 November 2015. The Val de Saône project enjoys a subsidy capped at €74 M from the European Union, within the framework of the 2011 recovery plan[19].

[17] Deliberation of 7 May 2014 giving guidelines on the creation of a single marketplace in France by 2018
[18] Deliberation of 30 October 2014 deciding on the incentive regulation mechanism for the Val de Saône and Gascogne/Midi projects
[19] GRTgaz obtained the transfer of the subsidy initially allocated to the ERIDAN project to the Val de Saône project.

The operators consider that the progress of work complies with the estimated schedule. Investments should be commissioned by 1 November 2018 at the latest.

CRE notes that TIGF and GRTgaz anticipate commissioning of infrastructure as at 1 November 2018, in line with the objective set for the creation of the single marketplace. In ENTSOG's TYNDP, these two projects are presented with the same commissioning date in 2018.

4.2.2 Creation of entry capacity at Oltingue

4.2.2.1 Presentation of the project

In its deliberation of 17 December 2014, CRE approved the project to create 100 GWh/d of capacity at the Oltingue interconnection point for a total of €12 M (± 30%) in 2018. The cost of the project was estimated mid-2017 at €17 M. GRTgaz anticipates the commissioning of this capacity between April and October 2018.

This project is mentioned in the list of projects in the TYNDP for commissioning in 2018, in line with the date presented by GRTgaz.

4.2.2.2 Summary of the public consultation

A shipper noted the deviation in costs for this project.

4.2.2.3 CRE's analysis

CRE notes that the project to create entry capacity at Oltingue exceeded the budget. CRE will analyse with the operator the reasons for this budget overrun.

4.2.3 The pilot power-to-gas project

4.2.3.1 Presentation of the project

The pilot Jupiter 1000 project consists in the construction of a power-to-gas demonstrator at Fos-sur-mer, the commissioning of which is scheduled for end 2018. This project should enable the study of the technical and economic validity of the power-to-gas process, with a view to its industrial development by 2030. This demonstrator will represent a hydrogen production capacity of 1 MWelec, and will enable two electrolysis technologies (membrane and alkaline) to be tested at the same site.

The project, approved by CRE in its deliberation of 17 December 2014[20], represents a total investment of €30.3 M. After deduction of public subsidies, the portion to be funded by GRTgaz totals €13.1 M (of which €10.1 in investments), and that of TIGF stands at €1.8 M.

The funding of this project is also based on a partnership with several technical industrial players (CNR, Atmostat, CEA, Leroux & Lotz, McPhy Energy), each of which brings their technology and technical expertise, as well as RTE and the Grand Port Maritime de Marseille.

4.2.3.2 Summary of the public consultation

An adjacent infrastructure operator is also developing a pilot power-to-gas project.

One contributor had reservations about the tariff treatment of the Jupiter 1000 project steered by the TSOs and reiterated that renewable energy production was not one of their missions. Another contributor requests the implementation of feedback on the project.

4.2.3.3 CRE's analysis

CRE reiterates that the project approved within the framework of the ATRT tariffs is a pilot project to study the effects of production on transmission networks. The aim of this approval is not to enable commercial development by the TSOs of this type of technology, nor to authorise them to enter into renewable gas production.

CRE requests the TSOs to present feedback once the project has been commissioned.

4.3 Projects under study

Almost all contributors consider that the capacity currently available is sufficient. Moreover, ENTSOG's 2017 report on the security of supply shows that in all scenarios envisioning a break in supply, France did not experience any drop in its supply.

4.3.1 The MidCat and STEP projects

[20] Deliberation of 17 December 2014 examining GRTgaz's 10-year development plan and approving its investment programme for 2015

4.3.1.1 Presentation of the project

The possibilities of developing additional interconnection capacity between France and Spain were the subject of a joint technical assessment by GRTgaz, TIGF and Enagas in 2015.

The MidCat project, which implies the development of 230 GWh/d of additional firm capacity in the Spain to France direction and 160 GWh/d in the France to Spain direction, would require, in addition to the new interconnection itself, the reinforcement of the French internal network particularly through the implementation of the Eridan and Est Lyonnais projects. The total investment costs necessary on the French side were estimated at over 2 billion euros by the three TSOs (GRTgaz, TIGF, Enagas). The MidCat project was identified as a project of common interest in 2015 and in 2017. The cost/benefit assessment done within the framework of the TYNDP 2017 shows that the benefits do not suffice to offset the cost of the project.

As for the STEP (*South Transit East Pyrenees*) project, it would comprise only a portion of these investments, i.e. those in the TIGF and Enagas networks. On the French side, it would include a 120 km pipeline between Le Perthus and Barbaira, for an estimated cost of €290 M. The TSOs' joint assessment concludes that, in this case, only interruptible capacity would be created. This project was examined within the framework of the high level group on Franco-Iberian interconnections. The ad hoc cost/benefit assessment conducted within this framework, concluded that France had nothing to gain, the benefits of the project would be exclusively in the Iberian Peninsula. The STEP project was identified as a project of common interest in 2017.

4.3.1.2 Summary of the public consultation

All contributors were against the MidCat and STEP projects, with the exception of an infrastructure operator. That operator considers that the projects included in the MidCat (ERIDAN and Est Lyonnais) project are necessary for debottlenecking the core of the French transmission network.

The other contributors consider that these projects must only be done within the framework of an open season and only on the basis of a positive cost/benefit assessment.

4.3.1.3 CRE's analysis

In its 2016 report on interconnections[21], CRE highlighted that, given the ability of the French system to handle supply crises, additional interconnection capacity with Spain (especially if they are interruptible) would not be useful for France's security of supply.

In addition, unless there are new requests from market participants, reflected by firm subscription commitments within the framework of an open season, CRE considers that the current interconnection capacity satisfies market needs, as shown by the existence of unsubscribed capacity in both directions, and the non-use of a significant portion of capacity subscribed, particularly in the Spain to France direction.

4.3.2 Backhaul towards Germany and decentralised odourisation

4.3.2.1 Presentation of the project

The possibility of enabling physical flows from France to Germany, of 100 GWh/d of firm exit capacity at the Obergailbach interconnection point, is being studied by GRTgaz, in connection with the European network code on interoperability. Such a project would require, in addition to the infrastructure that would have to be built in order for capacity to be created, an evolution in odourisation practices.

In that regard, the Odicée project is examining the solutions consisting of decentralising gas odourisation in the GRTgaz network. The total cost of investments necessary for the implementation of decentralised odourisation and the construction of infrastructure needed to enable backhaul flows to Germany was estimated in 2013 at about €600 M. A pilot installation is being implemented by GRTgaz at two sites, Etroeungt and Bas Lieu (North), in order to more accurately assess the technical feasibility and the cost of this solution. The initial elements of the cost/benefit assessment, presented in ENTSOG's 2015 network development plan, show insufficient benefits to cover the cost of deployment of such a project.

GRTgaz is examining alternative solutions, such as the use of a deodorisation unit on the North-East artery.

4.3.2.2 Summary of the public consultation

Most contributors are in favour of the termination of the decentralised odourisation project, before its deployment phase. With regards to the centralised deodorisation project, one infrastructure operator considers that this principle is a solution requiring major investments, without any benefits for French customers.

4.3.2.3 CRE's analysis

CRE notes that the project concerning backhaul to Germany based on a decentralised odourisation solution has not

[21] Electricity and gas interconnections in France – A tool for the construction of an integrated European market

been adopted for the third list of projects of common interest. Therefore, given the considerable costs of implementing a decentralised odourisation solution, CRE requests GRTgaz to not pursue this solution.

4.3.3 Conversion of the L zone into H gas

4.3.3.1 Presentation of the project

Part of the north of France, the "L zone" (B zone in French, in reference to gas of low calorific value), is supplied by gas from the Groningue production field in the Netherlands. Against a drop in the production of L gas, supply contracts in the zone expire in 2029.

Decree no. 2016-348 of 23 March 2016[22] specifies the regulatory framework and the general organisation of conversion. Within this framework, GRTgaz and the adjacent infrastructure operators (Storengy, GRDF and two local distribution companies) proposed on 23 September 2016 to the ministers of energy, industrial safety and the economy a conversion plan with the aim of ending conversion upon expiration of import contracts, i.e. 2029. In addition, it specifies that: *"the decision and the conditions under which infrastructure operators and transmission system operators implement such a change shall be the subject of a decree, following an economic and technical assessment by CRE to ensure that the measures envisaged are aligned with the proper functioning of the natural gas market for the benefit of end customers."* In September 2017, CRE commissioned an external firm to carry out a technical and economic assessment of the project.

A pilot phase is projected for the 2016-2020 period. The budget of the pilot project, for the portion to be conducted by GRTgaz, is estimated at €45 M. CRE, in its deliberation of 15 December 2016 examining GRTgaz's ten-year development plan and approving its investment programme for 2017, approved €9 M in expenses for 2017.

The conversion plan, subject to approval by the ministers concerned, provides for the drop in firm entry capacity at Taisnières B from 230 GWh/d to 115 GWh/d in 2025. GRTgaz specifies that the development of new H gas entry capacity will depend on market participants' demand. In line with the project presented by GRTgaz and operators, ENTSOG anticipates the commissioning of the pilot L zone conversion project by 2018.

4.3.3.2 Summary of the public consultation

Participants request transparency in the conversion plan presented by operators to the ministers of energy, industrial security and the economy, particularly concerning a possible acceleration in the conversion schedule.

4.3.3.3 CRE's analysis

In compliance with Decree no. 2016-348, CRE conducted a deliberation on 21 March 2018 to give an opinion on the L zone to H gas conversion plan, in which it presented the results of the technical and economic assessment, and made a certain number of demands to be implemented by the operators within the framework of the pilot phase, so as to examine, in view of the industrial deployment phase, several solutions for optimising costs and minimising the risks of this project. In a second deliberation, CRE shall define the financial trajectories of the pilot phase. Lastly, once certain uncertainties particularly concerning the operating procedures have been lifted thanks to the pilot sectors, CRE shall set the financial trajectories for the industrial deployment phase, and envisages, for that phase, setting up an incentive regulation mechanism for the entire project.

4.3.4 Development of adjacent infrastructure

4.3.4.1 Regasification capacity

Fosmax LNG, owner of the Fos Cavaou terminal is examining the possibility of doubling regasification capacity by 2023, with a possible intermediary stage as from 2021. GRTgaz specifies that the investments related to the Eridan and Est Lyonnais projects are necessary for the evacuation of gas at the terminal exit. In the 2017 TYNDP, drawn up in 2016 based on the 2015-2024 10-year plans, the terminal extension project is scheduled for 2022, with a possible intermediary phase in 2020, and the development of infrastructure necessary for evacuation of gas is set for 2022 in the GRTgaz network depending on the final development.

Elengy, owner of the Montoir de Bretagne terminal, plans for the increase in regasification capacity by 2021-2023. For this purpose, the Maine artery will have to be strengthened in the GRTgaz network. In the 2017 TYNDP, as for the Fos Cavaou terminal, the development of all of the necessary infrastructure on the GRTgaz network is aligned with the date of commissioning of the regasification infrastructure.

[22] Decree no. 2016-348 of 23 March 2016

	Commissioning scheduled by project promoters (2017 10-year plan)	Commissioning posted by ENTSOG (2017 TYNDP)	Capacity envisaged	Project status
Extension of the Montoir de Bretagne terminal	2021-2023	2020	+2.5 Gm^3	Not confirmed
Reinforcement of the network		2022		Not confirmed
Doubling of capacity at the Fos Cavaou terminal	2021 2023	2020	+2.75 Gm^3 +8.5 Gm^3	Not confirmed
Reinforcement of the network		2022		Not confirmed

CRE's analysis

CRE notes that the capacity extension projects for French terminals are properly inventoried within the framework of the 2017 TYNDP. The TYNDP distinguishes between the commissioning of adjacent infrastructure and the commissioning of transmission capacity necessary for the installations.

It however observes a discrepancy in the dates of commissioning of new capacity in the LNG terminals on the one hand, and the transmission network on the other hand: the commissioning dates indicated by GRTgaz are consistent with the commissioning dates presented in its 10-year plan.

CRE also notes that the commissioning dates of adjacent infrastructure were updated this year compared to the data published in the 2017 TYNDP, based on the 2015 10-year plan. It invites project promoters to forward their most up-to-date information for the preparation of ENTSOG's 2018 TYNDP.

4.3.4.2 Storage capacity

Géométhane intends to renovate the Manosque storage site, increasing its injection capacity in 2021, then its withdrawal capacity in 2022.

In addition, Storengy connected a new salt cavern at its Etrez site, which did not require the strengthening of the transmission network and is examining the recommencement of assessments of its Hauterives site, but did not give a deadline.

	Commissioning scheduled by project promoters	Commissioning posted by ENTSOG (2017 TYNDP)	Project status
Hauterives	2018-19	-	Not confirmed
Manosque	2021 and 2022	-	Not confirmed

Summary of the public consultation

Several participants are against the development of storage once any new project has to be paid for by long-term subscriptions. Against a reform of the activity, one participant considers that it is preferable to wait and see the perimeter adopted by the multiannual energy programme before planning any development projects.

In addition, Storengy specifies that:

- concerning the Hauterives site, the status of the project is “confirmed”, following the completion of work decided;
- concerning the Manosque site, the project is “suspended” and not “not confirmed”.

<u>CRE's analysis</u>

Within the framework of the reform of storage, the tariff set by CRE takes into account the perimeter of the current multiannual energy programme. Since work concerning the next multiannual energy programme is in progress, CRE, in its deliberation of 22 March 2018 on the tariff for the use of underground natural gas storage facilities of Storengy, TIGF and Géométhane, made provisions for a rendez-vous clause.

CRE notes that storage projects in France are not inventoried in the list of projects presented in the 2017 TYNDP. Therefore, it invites project promoters to ensure consistency in the information forwarded to the TSOs and to ENTSOG.

4.3.5 Development of the network related to electricity production

Only one plant project was under examination in 2017, the Landivisiau plant, located in Brittany, which is part of the Brittany electricity pact. Initially scheduled for 2018, it is not expected to enter into service before 2021 in GRTgaz's 10-year plan. To connect it to its network, GRTgaz is examining the reinforcement of the network in Brittany, which consists in the construction of a 111 km pipeline between Pleyben (Finistère) and Plumergat (Morbihan). The budget for this project is currently estimated at €100 M. GRTgaz obtained the declaration of public utility as well as ministerial authorisation in 2015. The progress of the project depends on the decision of the Landivisiau project promoter.

4.3.6 Biomethane in the networks: the use of backhaul

4.3.6.1 Presentation of the project

In compliance with CRE's deliberation of 17 December 2015, GRTgaz and TIGF examined the consequences of the development of the biomethane sector on TSOs' investment needs. The TSOs do not anticipate a drop in investments in connection with the development of biomethane injections, since the production of biomethane is currently not taken into account in the 2% risk calculation[23]. On the contrary, they have identified the possible emergence of new investment needs.

With the development of biomethane injection sites, the distribution networks could quickly become saturated, especially in summer, when gas consumption is low. To meet these injection demands, several solutions may be used (backhaul, network meshing, development of NGV stations). On the one hand, the development of the mobility sector will serve to increase distribution network withdrawals. On the other hand, GRTgaz conducted a statistical study to estimate the number of backhaul installations necessary for meeting the objectives of the energy transition act, depending on a certain number of assumptions: this study shows in 2017 about 100 backhaul installations necessary, 85% of which are D/T backhaul (Distribution to Transmission) and 15% T/T (regional transmission to main transmission) by 2030. According to GRTgaz, these investments represent an envelope of about €300 M, with the cost of a backhaul installation estimated between €2 and €3 M.

On an experimental basis, CRE, in its deliberations of 21 December 2017[24], approved for GRTgaz the West Grid Synergy project located in Pouzauges (Vendée) and in Pontivy (Morbihan), and for TIGF the launch of a pilot project within the framework of its research and innovation programme.

GRTgaz's project is based on the construction of two pilot backhaul installations from the distribution network to the transmission network (D/T) for 2019. These installations inverse the flow of gas compared to the usual flow between networks with different pressure regimes to send surplus gas production to the upstream networks. With regard to the development of Transmission/Transmission backhaul, on 1 June 2017, TIGF and Storengy announced the acceptability of green gas in their storage. CRE observes at this stage that the TSOs do not have any T/T backhaul development projects. In addition, the TSOs consider that this backhaul, in standard cases (without any particular difficulty), does not require any significant investment.

4.3.6.2 Summary of the public consultation

A shipper and an infrastructure operator agree with the development of backhaul projects, which would open the network to new methanisation projects.

4.3.6.3 CRE's analysis

[23] The 2% risk corresponds to an extremely cold winter as can occur every 50 years.
[24] Deliberations of 21 December 2017 approving the 2018 investment programmes for GRTgaz and TIGF

The TSOs and the DSOs presented a renewable gas injection trajectory requiring the commissioning by 2021 of 14 new backhaul projects: 7 in 2020 and 7 in 2021.

In its deliberations of 21 December 2017, CRE specified that: “a more global consideration should be undertaken at the same time [as development of the three pilot projects] by the TSOs and DSOs to assess the economic relevance of backhaul compared to other possible alternatives, and therefore determine a methodology for assessing and optimising backhaul installation needs”.

In this context, CRE is examining, in consultation with network operators, as for the development of backhaul, all of the mechanisms enabling the development of biomethane injection sites, such as network meshing and the development of mobility gas (development of NGV stations).

4.3.7 Adaptation of TIGF’s regional network

In its 10-year plan, TIGF presents several development and renovation projects for the regional network. These projects are justified by projections of increased consumption at both ends of the network (migration of populations outside of urban areas) and by the development of new public distributions.

By the end of the plan, TIGF forecasts two confirmed projects (development of the Landes south zone, renovation of the Capens–Pamiers pipeline) and three under study (reinforcement of the Montauban–Rodez–Albi and Arcachon-La teste zones, renovation of the Mont station).

5. CRE'S DECISION

1. Article L.431-6, I of the French Energy Code specifies that the TSOs shall draft, after consultation of interested parties, a ten-year development plan for their networks. That plan specifies the main transmission infrastructure that must be built or upgraded over the next ten years, lists the investments already decided, identifies new investments to be made over the upcoming three years and provides a forecast schedule for all investment projects.
2. The 10-year plan is submitted for CRE's examination so that it may ensure, on the one hand, that all investment needs are covered, and on the other hand, that the plan submitted is consistent with ENTSOG's network development plan.
3. CRE notes that the 10-year plans presented by the TSOs are in line with ENTSOG's plan.
4. With regard to market consultation arrangements, within the framework of the preparation of the 10-year plan,
   - CRE requests the TSOs to more widely consult market participants when preparing their plans.
   - in particular, CRE requests the TSOs to publish their 10-year development plans at the same time they are forwarded to CRE.
5. With regard to demand projection scenarios,
   - CRE requests the TSOs to explain in detail in the next forward-looking exercises and for each of the scenarios, the assumptions underlying the achievement of the objectives of the energy transition act and of the multiannual energy programme and any possible deviations. CRE requests GRTgaz and TIGF to adopt scenarios consistent with those proposed by RTE for electricity production;
   - CRE requests TIGF to present peak demand scenarios and the underlying assumptions.
6. With regard to the projected renewable gas injection trajectory,
   - CRE requests GRTgaz and TIGF to examine several scenarios and their consequences on network development needs;
   - CRE requests GRTgaz and TIGF to present underlying assumptions within the framework of Concertation gaz meetings.

Paris, 22 March 2018

For the Energy Regulatory Commission,

The Chairman,

Jean-François CARENCO