Union Française de l'Électricité

TECHNOLOGIES SUBJECT TO FEED IN TARIFFS

ANALYSIS OF THE SUPPORT SCHEME

The objective of this memorandum is to assess the support scheme currently developed in France for certain technologies (renewable energies, combined heat and power, etc.), in the light of the change in the energy mix impulsed by the energy transition.

This assessment concerns the support scheme and does not address the issue of financing.

This memorandum also looks into other support systems adopted in Europe in order to learn from the feedback of other Member States and understand the challenges they face.

Finally, it establishes several targeted criteria which should be met by any support scheme in order to ensure the achievement of the targets set by the government, and the transition, in the long term, to an effective market integration of supported technologies.

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Summary

For the purposes of the energy transition launched in France and in the framework of the European Commission guidelines, **UFE wishes the integration conditions of technologies benefiting from a financial support to be guaranteed, and the surplus costs of this support for the community to be known and controlled.**
Therefore, over the long term, what is at stake is the definition and control by governments, of a consistent target for each technology, and a path to achieve those targets.

The two main issues in the short term for the support scheme concern: on the one hand, the sensitivity of supported technologies to price signals from the market, and on the other hand, the security of the electricity system (supply/demand balance).

Regard to these issues for the electricity system and for the supported technologies development, the French feed-in tariff scheme has several strengths and weaknesses. That is also the case of other support schemes in place in main European countries where significant levels of supported renewable energies have been reached (Germany, Spain and Sweden).

It is to be noted, however, that the choice of a support scheme and its final design cannot on its own guarantee the successful development of a technology.

Moreover, UFE considers that a distinction must be made among the technologies entitled to support:

- Non-mature technologies, in respect of which the objective of support policies must be to promote innovation and R&DE, in order to improve their performance, before support to project development can be considered.
- Technologies closer to technical and economic maturity, in respect of which project development can be supported based on appropriate economic and industrial conditions.

UFE also highlights that, over time, technologies which fully compete[1] with conventional technologies should not benefit from support schemes.

Finally, any thinking on support schemes must ensure that it doesn't weaken the business model for existing feed-in tariff contracts.

Therefore, with regard to the challenges for the electricity system, UFE underlines that the support scheme should pursue the following objectives:

- **Guarantee the long-term stability and visibility of the support scheme for different investors in the electricity system (for investors in supported as well as non-supported energies).** This objective implies defining stable and long term targets and then managing the development

[1] Besides the return on capital, a competitive technology must be understood as capable of bearing risks of volumes and risks of market.

path, in line with declared public policy targets. This objective also implies that the support scheme must be financially sustainable over time.

- **Guarantee a normal return on capital invested**, taking into account the risks that producers bear (market risk, volume risk, financing risk, etc.) so as to encourage investment in supported technologies;

- **Avoid situations of economic inefficiency**. Through this objective, the goal is to avoid biases in support systems which may lead to situations which are contrary to the general interest.

- **Make producers or their representatives (aggregators) responsible for balancing**: production forecast, nomination, imbalances management.

- **Implement a gradual transition to market valuation of production while guaranteeing to all producers, irrespective of their size, equal access to the support scheme**.

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I. THE SITUATION IN FRANCE AND EUROPE

1. Significant change of the share, in the French electricity mix, of technologies benefiting from the feed in tariffs scheme .

Pursuant to the European objectives set out[2] in 2009 in respect of the final consumption of energy from renewable sources, France is targeting for 2020[3] a significant development of certain renewable energies, currently supported by the feed in tariffs scheme.

The development of these technologies is the result of targeted volumes defined by the Government. It is worth highlighting again that as long as some technologies are not competitive, their development will hinge on the existence of an appropriate financial support scheme offering a normal return on capital invested, taking into account the risks borne by producers (market risk, volume risk, financing risk, etc.).

It is to be noted that the feed in tariffs scheme is today applicable, subject to certain conditions, to renewable energies, as well as other forms of generation types such as combined heat and power.

Technologies benefiting from feed in tariffs (in terms of installed capacity) [4]

Capacity (GW)	As at 01/01/2013	2020 Estimate [5]
Photovoltaic	3,5	8,1
Onshore wind energy	7,0	19,1
Offshore wind energy	0	6
Hydroelectricity	1,4	1,4
Gas combined heat and power	2,7	1,3
Dispatchable Diesel	0,1	
Biomass combined heat and power	0,2	1,8
Biogas	0,2	0,6
Incineration	0,9	
Others	0,1	
TOTAL	**16,1**	**38,3**

[2] Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources

[3] The 2020 target regarding the share of renewable energies in final consumption is 27%.

[4] Hydroelectricity not falling under the feed in tariffs has an installed capacity of 23.2 GW

[5] Source: DGEC data from the June 2012 report of the Court of Auditors on the CSPE, except for hydroelectricity

While the volume of intermittent renewable energies does not represent today a major problem for the French electricity system, their integration is already causing difficulties in some countries such as Germany. These are likely to spread out due to market coupling.
Yet, in France, due to the significant development planned in these technologies, disruptions in the electricity system are expected to increase.

In this perspective, energy companies wish to look into the best system to prevent and overcome these difficulties. In fact, for UFE, this major change must be combined with the proper functioning of the electricity system.

For the purposes of the energy transition, the objective is to ensure both the right conditions for the achievement of renewable energies targets and market adequacy. Amongst others, it is important to analyse the necessary features of the schemes to support each technology.

2. Changes to support schemes in European countries where significant levels of supported renewable energies have been reached

Going by the installed capacity, Germany is today the largest producer of solar photovoltaic energy and the number one producer of wind energy, which accounts for 8% of electricity production for 29 GW installed in 2011. From these two main sources, electricity generation from renewable sources thus accounts for 21% of electricity production in Germany.

In Spain, the objective of electricity generation from renewable sources (40%) will be met shortly, thanks to significant hydroelectric generation and the increase in wind energy whose installed capacity has more than doubled in 5 years (from 10 GW installed in 2005 to 21.7GW in 2011, i.e. 16% of the country's electricity production).

Changes in the electricity generation mix of these countries have led them to think about more appropriate schemes to support renewable energies. The results of these changes are detailed in the section "Description and assessment of other existing support schemes" (Re. IV of this memorandum).

3. Future guidelines to be adopted by the European Commission regarding support schemes to non-competitive technologies

The European Commission, in a Communication[6] dated June 2012 on renewable energies, restated that the integration of these energies is a priority issue.
Regarding support schemes, the communication underlined its preference for schemes that encourage cost reductions and avoid over-compensations. Hence, mature technologies competing

[6] COM(2012) 271 final, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "Renewable Energy: a major player in the European energy market"

with other electricity generation technologies should ultimately no longer be supported but should be integrated into the market.

In this perspective, the Commission considers that support schemes must be reviewed in order to guarantee their economic efficiency, and recommends "moving as rapidly as possible towards schemes that expose producers to market prices."

However, the European Commission disapproved the conditions in which these changes to the support scheme have been made in some countries, and in particular the lack of transparency and the retroactive effect of changes made. The Commission considers that such practices, regarding recent technologies for which investment still depends on financial support, undermine investor confidence.

This is why the European Commission wishes to ensure greater consistency in national approaches, through non-binding guidelines, to be drawn up soon, on the reform of support schemes based on experience gained and good practices identified in Member States.

II. ISSUES RELATED TO THE ELECTRICITY SYSTEM AND THE ENERGY MARKET

1. Long-term issues: impact on investment in the market

What is at stake is the definition and control by governments, of a consistent target for each sector, and a path to achieve those targets.

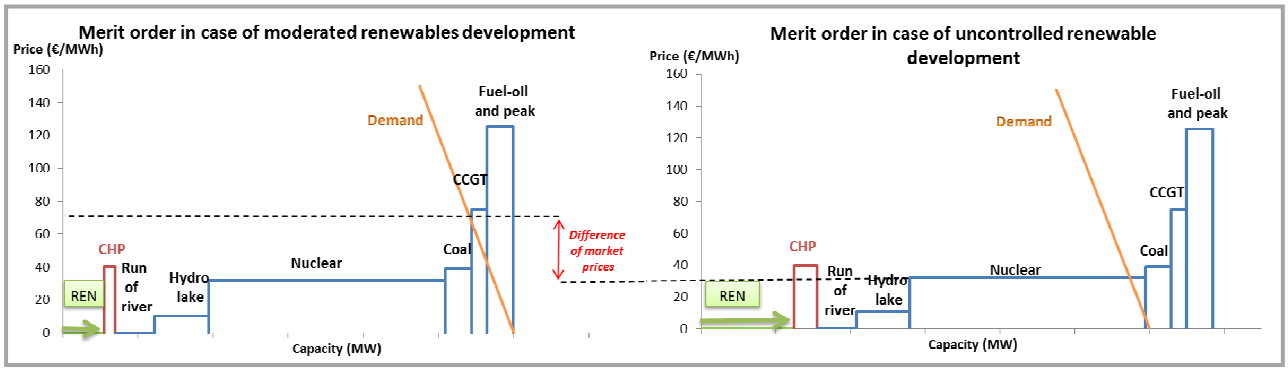
In fact, the decision today to invest in supported equipment is motivated by public policies and not by the needs to achieve the balance between supply and demand, unlike investment in any other production equipment. In the long term therefore, **the main issue arising is the control of the development path and milestones.**

For instance, the fast development of some technologies in several European countries, and in particular in Germany, without taking into account the adjustment of the existing production and changes in consumption, led to an overcapacity situation. Conversely, the lack of quick reaction in the management of volumes may lead to a delay in the achievement of the targets set out, which is the case for onshore wind energy in France for instance.
However, this seems to have more to do with the project selection system than with the support scheme in these technologies. As an example, irrespective of the financial support system, the call for tender scheme can be used to control the volumes developed. On its own however, it cannot guarantee that the set targets will be attained.

Moreover, fast and consequent investment in technologies benefiting from a support scheme have a profound impact on the business model of other technologies governed by market rules (in particular CCGT) which, all things being equal, experience declining operating hours and fall in income. The simplified example of merit order (Re. charts below) illustrates the impacts of the integration of non-supported technologies in higher proportions than planned.

The integration of the technologies on the left of the merit order impacts **non-supported technologies, which experience declining operating hours and decrease in profitability.**

The significant development of fatal energies at zero variable cost, at a much more rapid pace than planned and necessary to meet the increase in consumption, leads to an over-capacity, which has a downward impact on wholesale prices. It is to be noted that this fall in wholesale prices makes even harder the convergence between the production cost of supported technologies and the average wholesale price of electricity, and thus the sale of their production on the wholesale market. It results in higher charges attributable to public service missions.
This unpredictable impact for investors in the electricity sector must be prevented by a public policy which declares and respects the pace of development of these technologies.



2. Short-term issues: optimising the functioning of the market

One of the main issues of the scheme, in the short term and for the market, concerns the sensitivity of supported technologies to price signals from the market.

Economic efficiency requires each plant to supply its production at its variable cost and to stop operating when this variable cost is higher than the market price. However, under guaranteed tariff schemes, these market price signals are not perceived by the producer, which produces irrespective of the constraints of the electricity system, and of market prices, although they reflect the real value of its production.

However, within **technologies that can benefit from support schemes**, a distinction must be made between **technologies** where the production can be controlled upward and those whose production, which is fatal[7], can only be controlled downward by being interruptible:

Technologies eligible to feed in tariffs	Can be controlled upward	Interruptible	Fatal
Photovoltaic		X	X
Biomass combined heat and power	X	X	
Onshore wind energy		X	X
Offshore wind energy		X	X
Run-of-river hydroelectric power		X	X
Gas combined heat and power	X[8]	X	

The technologies which can be controlled upward can optimise their production profile and their maintenance period to take into account the constraints of the electricity system as highlighted by market prices.

For technologies where production is fatal and variable costs are nil, operation largely depends on weather conditions (sun for PV, wind for wind energy, water flow for hydroelectric power).

Their maintenance is different: hydroelectric power and wind energy are based on weather forecasts and PV on manufacturers' contracts.

Maintenance periods for these plants could be scheduled taking into account foreseeable constraints in the electricity system, but in reality their impact is only marginal compared to other constraints (volume of primary energy, availability of sub-contractors, etc.).

Moreover, it is necessary to guarantee the economic efficiency of the electricity system. This requires producers to supply their production at its variable cost and to stop producing when this variable cost is higher than the market price. When this principle is not respected, it leads to negative prices, as was seen in Germany (Re. text box).

Units of all technologies are potentially interruptible[9]. It is therefore technically possible, at any time, to suspend their electricity production.

[7] Any technology subject to climatic variations, and which cannot therefore be controlled upward (wind energy, hydroelectricity, photovoltaic energy, etc.), is considered as fatal.
[8] The upward optimisation of combined heat and power is still dependent on the need for heat.
[9] Combined heat and power: subject to meeting the needs for heat

Negative prices

Among the reasons leading producers to supply their electricity at negative prices, it is worth highlighting the following:

- Economic reasons: this is the case of conventional producers for which stopping thermal production units over a few hours only can be costly due to their technical and economic constraints (costs of start-up, minimum power, minimum stoppage time, etc.). Hence, they may prefer to pay to produce in order not to have to stop their production unit which would cost even more. This results in negative supply prices over all or part of the period over which the producer wishes to avoid the stoppage of its unit. In practice, such supply at negative prices thus reflects the cost of stoppage (and its trade-off against the expectation of savings over the following hours).

- Poor design of the support scheme: the case of Germany. Producers subject to the feed in tariffs were encouraged to produce as much as possible irrespective of the market price. The obligated buyers were compelled to sell the electricity produced by the technologies subject to feed in tariffs on the wholesale market. They were therefore led to supply this energy "at any price" to ensure that they can sell their production (since electricity cannot be stored on a large scale). This is why massive volumes were offered at negative prices, which led the market to witness negative prices episodes, during periods of low demand. In this case, such supply at negative prices does not reflect the cost of stoppage. Since then, changes to the support scheme in Germany and market coupling have contained the magnitude of this phenomenon without however addressing it completely (see above).

The second short-term issue relating to the development of supported technologies concerns the security of the electricity system (supply/demand balance). The participation of producers eligible to the support scheme, like any other player, in the real time management of the balancing is desirable, as long as it is economically justified, and technically possible.

This real time management can be of two types.

- Firstly, producers benefiting from the support scheme could be encouraged to contribute to the system's supply/demand balance by offering supply on the French balancing mechanism based on their economic characteristics (costs or loss of opportunities of production) and technical characteristics (dynamic constraints). Even if the format of the supply can be limited for certain technologies (offer of downward adjustment), it can improve the means of action of the transmission system operator in the balancing management.

- Secondly, network codes can compel producers eligible to the support scheme to contribute to ancillary services (voltage and frequency) provided it is technically feasible to do so.

The participation of these producers in the real time balancing would also send strong economic signals to equipment suppliers, so that incremental technological innovations can address the "conformity" of equipment, like any other classical technology, to be connected to the networks.

III. DESCRIPTION AND ASSESSMENT OF THE FRENCH FEED IN TARIFFS SCHEME

1. Description of the scheme

The scheme to support some production technologies is defined by Articles L314 and L311 of the Energy Code. EDF and local distribution companies are required to sign contracts for the purchase of electricity produced by some technologies based on terms, in particular related to prices, which can be determined in two ways: **through regulations or by launching calls for tenders.**

Where the purchase price is determined through regulations, a tariff is fixed according to the advice of the *Conseil Supérieur de l'Energie* and the *Commission de Régulation de l'Energie* (Regulatory Commission of Energy: Independent administrative body in charge of regulating the French electricity and gas markets). These tariffs and the duration of contracts are differentiated on the basis of technology. The differentiation of these factors by technology makes it possible to take into account the cost of development of the technologies considered. The electricity feed in tariffs must ensure a normal return on capital invested.

Where the purchase price is determined following a call for tender, the tariff is equivalent to the one proposed by the selected tenderer. Tenders lead to the selection of projects that are the most competitive and that meet a number of pre-determined criteria, while defining a volume to be developed in principle.

The advantage of the feed in tariffs, for the producer eligible to the support, is that it ensures visibility over income from these investments, does not contain any market risk relating to off-take of the volume or to the price, nor any risk relating to differences between forecast and actual production, nor any counter party risk. It thus secures the financing of the supported projects.

Typically, it implies the purchase of electricity produced at a guaranteed tariff for periods ranging between 10 to 20 years.

The law provides that surplus costs compared to market prices resulting from this feed in tariffs are fully compensated by the "CSPE" paid by final electricity consumers[10].

[10] Excluding Corsica and Overseas Departments

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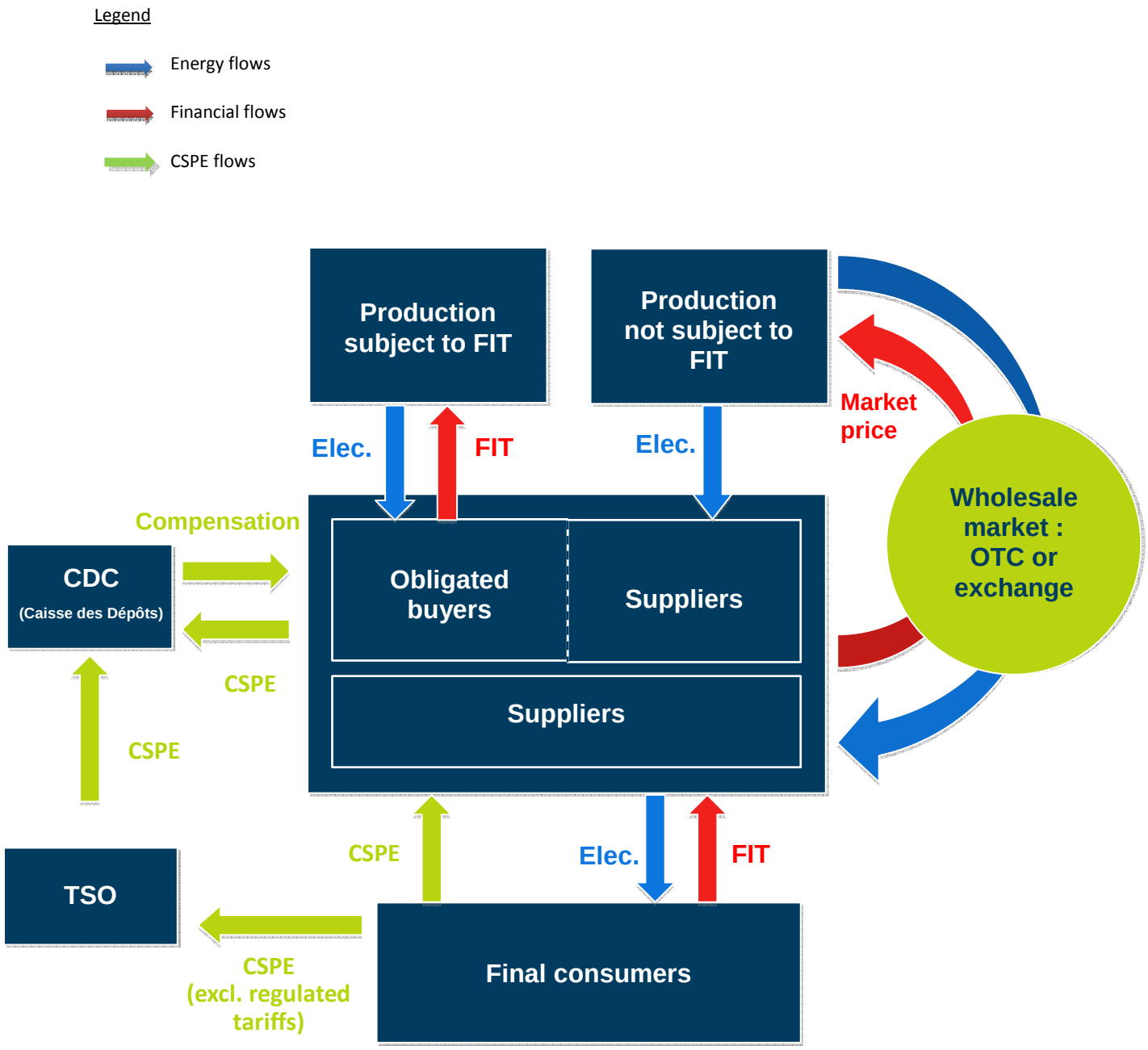
Feed-in tariff support scheme



2. Assessment of the scheme

A SWOT (Strengths/Weaknesses - Opportunities/Threats) analysis of the current French support system was carried out.

	STRENGTHS	WEAKNESSES
	Assessment of the scheme **with regard to the development of the supported technologies**	
INTERNAL	**I. The scheme ensures clarity for the producer and the technology:** • *On the producer's remuneration:* - a purchase price determined independently of the market price provides clarity on income - the reliability of obligated buyers provides a guarantee of payment. - the duration of feed-in tariff agreements facilitates the financing of highly leveraged projects and the start of development of a new technology based on the targets (seed phase). • *On the volume:* - the guarantee of off-take of the entire production represents a security for producers - the producer is no longer exposed to the risk of uncertainty over the quantities that it produces. **II. The scheme's simplicity facilitates its access to small producers**	**I. The scheme (excluding calls for tenders) does not ensure an effective management of installed volumes.** For technologies where the cost changes rapidly downward, the review of the purchase tariff may not be as rapid. It may lead to a surge in development projects due to the overly remunerative nature of the feed in tariffs. In contrast, an overly low tariff results in insufficient development. The lack of responsiveness of the scheme can therefore create over capacities or under capacities with regard to the target set out by the government.

INTERNAL

STRENGTHS	WEAKNESSES
Assessment of the scheme with regard **to the functioning of the electricity system**	
I. The scheme gives better forecast results: - The production forecast covers a shared scope, hence more significant technical and methodological resources can be mobilised. - The balancing of productions benefiting from feed in tariffs is done upfront mainly by the main obligated buyer, which uses the physical resources at its disposal to address this intermittent production. **II. The methods of purchase of production, defined by a ministerial order, are transparent and non-discriminatory, thereby ensuring equal treatment for all producers**	**I. Production benefiting from feed in tariffs is managed independently of the supply- demand-balance of the electricity system:** - The scheme does not encourage producers to optimise their production profile taking into account the market value of production (producer's sensitivity to market prices nil), by their choice of timing of stoppages for maintenance or, for combined heat and power or biomass plants, by their choice of timing of production. - With the current scheme, producers cannot make downward adjustment offers on the balancing mechanism (for example wind energy) which would allow the TSO to ensure the overall supply-demand balance for France at the best price for the community; - Producers are not made responsible for the forecast of their production or for the adjustment needs that they can generate. **II. The volumes benefiting from feed in tariffs** (of the order of 30 TWh annually) are directly integrated in the portfolios of obligated buyers and do not necessarily go through the market (OTC or exchange), hence reducing the volume traded amongst players. Moreover, obligated buyers are also players in the competitive field, and this is detrimental to the clarity of the scheme. **III. The scheme's procedures** do not ensure the transition from the feed in tariffs to market valuation at the end of the feed in tariffs agreement. **IV. The scheme does not encourage location optimisation** so as to alleviate congestion problems (excluding cases of localised calls for tenders).

EXTERNAL

OPPORTUNITIES	THREATS
I. The scheme is compatible with Directive 2009/28/EC on the promotion of renewable energies; in particular i²nsures priority of injection into the grid.	**I. Lack of visibility over the cost of support and thus over the need for subsidy (uncertainties over the market price and volumes benefiting from feed in tariffs).** **II. In the current scheme, production means, excluding FIT, single-handedly bear all the constraints of the electricity system.**

IV. DESCRIPTION AND ASSESSMENT OF OTHER EXISTING SUPPORT SYSTEMS

Besides the feed in tariffs scheme, as it exists in France, three main categories of support systems can be distinguished:

1. Contracts for difference (or ex-post premium)

Description of the scheme principles:

Generally, in a system of contracts for difference, producers sell their energy at the wholesale market price and receive an additional remuneration in the form of a premium when the "difference" between the benchmark and market price is positive. When this difference is negative, producers must pay back the surplus received.

This system is compatible both with the call for tender scheme, where volumes developed can be managed, and with the *"open window*" system, i.e. without limit on quantity (which does not select projects and thus does not control volumes developed).

One of the variations of the contract for difference consists in not requiring the producer to pay back the surplus when its remuneration on the energy market exceeds the benchmark. It is then an "asymmetric contract for difference" (or asymmetric ex-post premium), which was introduced in Germany in particular.

A practical illustration: the case of Germany

The premium amount expressed in €/MWh is calculated ex-post based on actual recorded market prices weighted by the total production of the type of renewable energy considered. This premium differs depending on technologies.
This system has been in place in **Germany** since 1 January 2012 to support renewable energy technologies.
Producers choose between selling their production at the guaranteed tariff and selling it at the market price + premium. In the case of the feed in tariff system, obligated buyers are the four German transmission system operators. The shift from one system to the other is possible on a monthly basis.

If the producer chooses to sell its production at the market price, its income will be made up of three components:

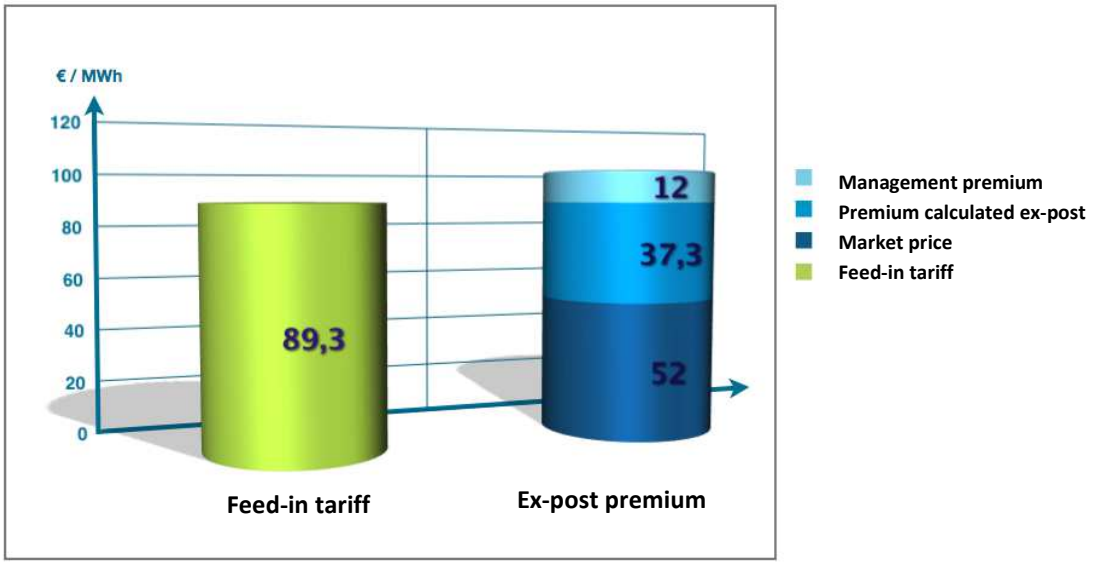
- **The price obtained from the sale of its production on the energy market**
- **A premium calculated ex-post by technology**

- **A fixed, management premium,** aimed at covering the management costs of the balancing and the marketing. This premium, initially set at €12 /MWh in 2012 was made up as follows:

  - €5.8/MWh: cost of balancing renewable energies expected by the TSOs
  - €3.2/MWh: balancing learning bonus (decreases the following years to completely disappear over time)
  - €1/MWh: coverage of marketing costs
  - €2/MWh: marketing learning bonus (decreases gradually, then 0 in 2015)

The share relating to the balancing costs of renewable energies (€5.8/MWh) has since been revised by the TSOs to €2.5/MWh, which led to a downward revision of the management premium.

The German onshore wind case



Assessment of the German scheme

This scheme has the following characteristics:
- lack of control over the volume of production of renewable energies developed,
- awareness of energy producers about sale on the electricity wholesale market and about market price signals,
- the possibility to reverse the choice between the feed in tariff and remuneration (market price + premiums), which implies a sufficiently attractive premium to encourage producers to leave the previous system,

- a method of calculation of the ex-post premium based on the average monthly wholesale price, which leads to a smoothing out of market signals and which does not support possible opportunistic behaviour by market players (since it is still in producers' interest to supply at negative prices).

2. Ex-ante premium

Description of the scheme principles:

Producers sell their energy at the wholesale market price and receive an additional remuneration in the form of a premium. The premium is initially calculated and defined for a specified period. It is equivalent to the difference between the full cost of production estimated by the producer, and the forecast of future wholesale market prices.

The "ex-ante" premium can be of two types: an energy premium expressed in €/MWh or a capacity premium in €/MW/year.

➢ *Energy premium expressed in €/MWh*

The premium amount is determined on the basis of an estimate of future market prices, to provide remuneration expected to be equivalent to the full cost of the plant. There is therefore an uncertainty for the producer over the full remuneration, which will depend on actual recorded market prices.

A practical illustration: the case of Spain

Spain, like other countries, used this system until 2007. However, in order to contain the price risk for the producer, Spain has fine-tuned the scheme by introducing cap and floor levels for the producer's full remuneration (market price + premium) at any time. In the Spanish system, suppliers are the obligated buyers.

Assessment of the Spanish scheme

This scheme has the following characteristics:

- lack of control over the volume of production of renewable energies developed,
- awareness of energy producers about sale on the electricity wholesale market and about market price signals,
- (partial) exposure of the producer to a risk of remuneration.

➢ *Capacity premium expressed in €/MW/year*

The difference with the above case is that the premium is no longer a function of the energy produced but is based on the installed capacity.

The producer's remuneration is therefore made up of a capacity premium paid annually over a specified period and determined contractually and income from the sale of its production on the market.

Practical illustration: case of the tender launched by the CRE in 2011 for the creation of a combined-cycle gas turbine (CCGT) in Brittany

This scheme was introduced in France in 2011 by the CRE in connection with a tender for the creation of a Combined-Cycle Gas Turbine in Brittany. The selected tenderer is remunerated as follows:

- an annual fixed premium, as proposed by the successful tenderer in its proposal;
- the sale of electricity produced on the wholesale market.

In return, the selected producer gives an undertaking as to the capacity level and the percentage availability of the proposed plant.

Assessment of the tender scheme launched by the CRE in 2011 for the creation of a CCGT in Brittany

This scheme has the following characteristics:

- control over the volume of production developed,
- awareness of energy producers about sale on the electricity wholesale market and about market price signals,
- exposure of the producer to a risk of remuneration.

3. Green certificates

Description of the scheme principles:

In this scheme, obligated buyers[11] are subject to the legal obligation to certify the renewable source of a percentage of the energy that they supply to their clients. They certify this source by holding green certificates which they acquire from new producers of renewable energy. They are subject to a penalty if they do not hold enough certificates with regard to their obligation.
Certificates are therefore traded amongst producers of renewable energies and electricity suppliers on a market which discloses the price. Thus the remuneration of the renewable energy producer is the sum of the sale of the energy produced and of the related certificate.

A practical illustration: the case of Sweden

In the case of the Swedish scheme implemented in 2003, each MWh of renewable energy produced generates a green certificate, irrespective of the technology, provided it is an approved technology[12]. The parliament determines the long-term objective (e.g.: 25 TWh in 2020) of production of renewable energy, the scheduling and the annual quota curve imposed on suppliers (e.g.: 18 % in 2012). The certificates obtained do not have an expiry date and can thus be kept as reserve to be used later.

[11] In Sweden, obligated buyers are electricity suppliers; in Italy, obligated buyers were generators.
[12] It is to be noted that any increase in the hydro-energy production capacity, even based on existing plants, is eligible for green certificates.

Suppliers surrender the certificates, in proportion to their sale or consumption, on an annual basis. The scheme also provides for a penalty, which does not constitute a discharge from obligations, of 150% of the average recorded price of the certificate in the event of non-surrender.

Assessment of the Swedish scheme

This scheme has the following characteristics:

- control over the production capacities of renewable energies developed thanks to high levels of penalty and stable targets
- the development of renewable energies by increasing order of production costs, (which in the case of Sweden, is onshore wind energy first) with cost minimisation for the community,[13]
- the development of an industrial technology is independent of political will,
- awareness of renewable energy producers about sale on the electricity wholesale market and about market price signals,
- exposure of renewable energy producers to a two-fold market risk: that of electricity price and that of the price of green certificates.

Note: To address this uncertainty, Italy and the UK have complemented the scheme by a system of last resort buyer of green certificates at a minimum guaranteed price. These two countries have since abandoned the green certificate scheme. In the Swedish case, in spite of the two-fold market risk, the permanence of political will and of targets has contributed to the attractiveness of the scheme to investors.

[13] However, there are possible dead weight effects, which can be of benefit to the first technologies developed, when the price of green certificates increases to balance the following technologies in increasing order of costs.

V. RECOMMENDATIONS

The above assessment shows that each support scheme has promoted the development, at different paces, of some non-competitive technologies.

It is to be noted, however, that the choice of a support scheme and its final design cannot on its own guarantee the successful development of a technology.

The support scheme is a key factor for the development of a technology. However, other factors, such as national and local political commitment, necessary grid development for energy evacuation, administrative procedures, or the number of parties involved in the management of the project, and local acceptability, also contribute to the success or failure of support policies.

This is why UFE considers that it is vital for the tools of these support policies to be consistent with the development targets.

Moreover, UFE considers that a distinction must be made among the technologies entitled to support:

- Non-mature technologies, in respect of which the objective of support policies must be to promote innovation and R&DE, in order to improve their performance, before support to project development can be considered.
- Technologies closer to technical and economic maturity, in respect of which project development can be supported based on appropriate economic and industrial conditions.

UFE also highlights that, over time, technologies which fully compete[14] with conventional technologies should not benefit from support schemes.

Finally, UFE considers that it is necessary to guarantee to players and in particular to investors, a stable regulatory environment. Any thinking on support schemes must therefore ensure that it doesn't weaken the business model for existing feed-in tariff contracts.

With regard to the challenges for the electricity system, UFE underlines that the support scheme should pursue the following objectives:

- **Guarantee the long-term stability and visibility of the support scheme for different investors in the electricity system (for investors in supported as well as non-supported energies).** This objective implies defining stable and long term targets and then managing the development path, in line with declared public policy targets. This objective also implies that the support scheme must be financially sustainable over time.

[14] Besides the return on capital, a competitive technology must be understood as capable of bearing risks of volumes and risks of market.

- **Guarantee a normal return on capital invested**, taking into account the risks that producers bear (market risk, volume risk, financing risk, etc.) so as to encourage investment in supported technologies;

- **Avoid situations of economic inefficiency.** Through this objective, the goal is to avoid biases in support systems which may lead to situations which are contrary to the general interest.

- **Make producers or their representatives (aggregators) responsible for balancing:** production forecast, nomination, imbalances management.

- **Implement a gradual transition to market valuation of production while guaranteeing to all producers, irrespective of their size, equal access to the support scheme.**