



Report for PPC

Regulated access to wholesale base-load energy: lessons from French experience

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Section 1

Executive summary

A Introduction

- 1.1 The Greek energy regulator, RAE envisages introducing a regulatory mechanism to allow independent retail suppliers to access the base-load lignite and hydro electricity production. According to RAE, this mechanism has similarities with the regulated access to the historical nuclear energy (ARENH) in France under the “loi NOME”.¹
- 1.2 In its recent consultation², RAE suggests that access will be gradually gained through forward auctions where a fixed price or a range of minimum/maximum prices will be defined. Allegedly, only electricity suppliers will be eligible to participate in these auctions.
- 1.3 To ensure that the regulatory mechanism envisaged by RAE indeed helps developing retail competition in Greece without creating unnecessary market distortions, such a mechanism should meet a number of criteria. In this report we identify these criteria based on the French experience with the similar mechanisms, as well as based on the general economic theory.

B RAE’s proposal

Objectives of RAE

- 1.4 For a variety of historical reasons, nearly entire Greek electricity retail market is currently supplied by the historical provider PPC. According to RAE, the right conditions for efficient market competition have not been created in the retail market. RAE has published a consultation document regarding the creation of a regulated mechanism, allowing retail suppliers to access forward base-load electricity from lignite power and hydroelectric plants.
- 1.5 Although this is not explicitly mentioned in the consultation, our understanding is that the mechanism is intended to price these forward electricity products below the market price (whilst at or above production cost of PPC), to provide alternative suppliers with the cost structure similar to that of PPC. According to RAE’s consultation document, the envisaged regulated mechanism would positively impact competition in the electricity retail and wholesale markets as well as the final consumers’ electricity bill.

¹ RAE, “Τελικές προτάσεις της Ρυθμιστικής Αρχής Ενέργειας για την αναδιοργάνωση της εγχώριας αγοράς ενέργειας”, November 2012

² http://www.rae.gr/site/categories_new/about_rae/factsheets/2014/major/07052014.csp

Proposed mechanisms

- 1.6 The mechanism proposed by RAE would give the right to the suppliers licensed to serve domestic load to acquire forward base-load energy products. The maximum amount allocated to each retail supplier will be based on the consumption of each supplier's customers. However, exact processes of monitoring and correction of volume allocations are not yet defined in details.
- 1.7 The overall volume of the offered forward products is expected to cover 25-30% of the annual lignite and hydro production.
- 1.8 According to RAE, the forward products will either be allocated to eligible suppliers directly or through auctions. RAE presents two alternative types of auctions:
- **Price Auction.** In this type of auction, the forward products are allocated to buyers with the highest price bids within the pre-defined price range. Based on the figures provided in the consultation, the pre-defined price range would be rather narrow, with the upper bound possibly below the market price. The levels of deposit and advanced payment required to participate in the auction are defined upfront;
 - **Deposit Auction.** In this type of auction, the price of the forward product is defined upfront. The product is then allocated to the buyers offering the highest level of deposit and advanced payment.
- 1.9 So far, the RAE's proposal lacks details on how the fixed price will be defined in case of the direct allocation or in case of allocation through a Deposit Auction, or on how the price range will be determined in a Price Auction. The current proposal does not provide evidence that these prices would cover the full costs to generate power from lignite and hydro, including a reasonable rate of return on the past and future required investments.
- 1.10 Two different mechanisms have been implemented in France in different periods that sought to respond to objectives that are similar to those of RAE, albeit in different contexts:
- French ARENH mechanism implemented from 2011 to date, and
 - French VPP mechanism implemented between 2001 and 2011.

C French ARENH mechanism (2011 to date)

- 1.11 The ARENH mechanism implemented in July 2011 is an element of the law on the New Organisation of the Electricity Market, known as the NOME³ law, published in December 2010.
- 1.12 ARENH mechanism, as proposed by the Champsaur report,⁴ is aimed at reconciling two main objectives:

³ NOME stands for « Nouvelle organisation du marché de l'électricité ».

⁴ http://www.dgcis.gouv.fr/files/files/directions_services/secteurs-professionnels/etudes/rapport_champsaur.pdf

- On the one hand, to allow French consumers to continue to benefit from the advantages of the competitiveness of “historical nuclear power”, and thus, to obtain low end-user electricity prices effectively capped by rather low regulated tariffs;
 - On the other hand, to comply with the European Directives and the liberalisation objectives, allowing new entrants in the retail market to compete with the historical operator EDF and to gain market shares for the benefit of end users.
- 1.13 The regulated retail tariffs existing in France are on average below the wholesale electricity market prices. This has raised concerns about development of competition in the French retail market, since alternative suppliers that buy electricity in the market would not be able to offer retail prices competing with the regulated tariffs without making a loss.⁵ The ARENH mechanism was intended to correct this situation following the request of the European Commission to the French Government.
- 1.14 The ARENH mechanism sets the obligation for EDF to sell each year up to 100 TWh of its nuclear base-load production (around 25%) to its alternative suppliers and end-consumers at a regulated price.
- 1.15 The rights to access the energy under the ARENH mechanism are allocated to alternative retail suppliers according to the consumption of each supplier’s customers in France during the hours of low national consumption. Suppliers request ARENH rights based on their expectation of their customers’ consumption in France. In case the declared consumption of French customers of a supplier exceeds the realised consumption, the number of ARENH rights allocated to the supplier would be adjusted ex-post.
- 1.16 For the first years of the existence of the mechanism, the regulated price was decided by the Ministry after the regulator’s opinion. It was set to ensure a fair compensation of EDF. The price was initially established at 40 €/MWh for the 2nd semester 2011, and since 1 January 2012 it has been fixed at 42 €/MWh.
- 1.17 The ARENH mechanism aims at transferring part of the cost advantage of nuclear power to alternative suppliers by giving them access to energy products below market price. The purpose of the allocation rule is to allow the share of ARENH in alternative suppliers’ portfolios to match the share of nuclear production in electricity production in France (~80%). As a result, alternative suppliers should have a cost structure similar to EDF’s and should be able to offer retail prices allowing them to compete with EDF’s regulated tariffs for different segments of consumers.
- 1.18 This should have in principle given alternative suppliers a better opportunity to make competitive offers in the retail market and allow them to gain market shares to the benefit of consumers. Yet, as of today the ARENH mechanism has not made a significant impact on the growth of market shares of alternative suppliers neither in the residential nor the non-residential sector.

⁵ <http://www.cre.fr/documents/publications/rapports-thematiques/fonctionnement-des-marches-de-detail-francais>

- 1.19 The likely reason for the weak impact of ARENH on the development of competition is that the regulated tariff offered by EDF for most types of end-consumers does not actually cover EDF's costs⁶ and is too low to be contestable by its competitors. Hence, the French experience suggests that the impact of the regulated ARENH mechanism on competition in the retail market could be limited, as long as tariffs are regulated at levels below the costs of the historical supplier.

D French VPP mechanism (2001-2011)

- 1.20 A Virtual Power Plant, or VPP, is a commitment (voluntary or requested by authorities) of a dominant generator to sell the rights of using its plants to its competitors. In economic terms, VPP is a sale of electricity capacity allowing the owner of the plant to retain management and control of the plant. However, the VPP energy contracts allow the buyer to replicate the output of the plant. VPP may involve a sale of divisible goods of varying durations, offered in periodic open and transparent auctions.
- 1.21 VPPs have been widely used by regulators in European electricity markets as a tool to promote competition in a context of liberalization of electricity markets with one or more dominant firms. They were used as "virtual" rather than "physical" divestiture by dominant firm or firms in a market.⁷ Another objective of VPPs is to create liquidity in the forward energy markets and to simplify the access of the alternative suppliers to the wholesale energy. In Europe, VPPs were used in Belgium, Czech Republic, Denmark, France, Germany, Italy, Ireland, the Netherlands, and Spain.
- 1.22 In France, VPPs were required by the European Commission following the acquisition of EnBW by EDF in 2000 as a remedy to eliminate the strengthening of EDF's dominant position on the retail market in France as a result of the acquisition. They were implemented between September 2001 and November 2011. EDF committed to sell 5,400MW of generation capacity located in France in the form of virtual power plants' auctions. Most of the volume (4,400MW) was offered as base load options of several maturities between quarter and three years. A small volume (1,000MW) was offered as peak load options. The volume EDF made available to competitors represented approximately 40 TWh per year.
- 1.23 Participation in VPP auctions was high (around 30 players competing and around 20 players had successful offers) and no limit on the purchase volumes was imposed on buyers. As a result of high competition for accessing the base-load VPP products, the prices of these products traded in the auctions have closely matched the price of forward products of the same maturities traded in the market.

⁶ Except for small companies under « tarif bleu professionnel ».

⁷ Ausubel, L. M., & Cramton, P. (2010). Virtual power plant auctions. *Utilities Policy*, 18(4), 201-208.

- 1.24 The French VPPs have increased liquidity of the forward products and reduces transaction costs. However, unlike ARENH, VPPs did not allow a significant transfer of the cost advantage of nuclear power from the historical operator EDF to alternative suppliers. Due to a reasonably high level of competition and no limits on purchase volumes, the VPP prices reflected market conditions more than EDF's costs. As a result, VPPs were not substantially reducing costs for alternative suppliers.

E Determination of the price of regulated wholesale product

- 1.25 In the French ARENH mechanism, the regulated price has been initially decided by the Ministry after the regulator's opinion. The NOME law states that "to ensure fair compensation to EDF, the ARENH price, reviewed annually represents the economic conditions of electricity generation by historical nuclear power plants in the period of the measure"⁸.
- 1.26 Although this general principle may seem straightforward, the example of ARENH shows that its implementation in practice may not be easy.
- 1.27 Several methods were proposed to determine the initial ARENH price providing very different results in a wide range between 32€/MWh and 90€/MWh. Naturally, the choice of the methodology was a topic of hot debates. The highest value was provided by the Cost to Build as New method that calculates the price based on the cost to build and to exploit the most up-to-date nuclear technologies. A method referring to the existing nuclear technologies has provided a lower value. Finally, methods taking into account the current net accounting value of the nuclear assets (depreciation, refurbishment) have further reduced the price.
- 1.28 The method currently used in the French ARENH mechanism to determine the regulated price of the base-load wholesale products is based on the accounting value of the depreciated assets, taking into account the historical refurbishments and the investments necessary for the life time extensions. It has also taken into account the costs of investments related to the new safety guidelines introduced following the Fukushima accident.
- 1.29 In the French VPP mechanism, the price was determined in the auction and no price reference was administratively set. However, one may still want to introduce elements of price regulation in such a market-based mechanism, such as a price floor or a price cap. The price floor or an auction reservation price may be needed to limit the risk of the incumbent of selling at a price below the level representing its economic conditions. A price cap in a VPP auction may be envisaged to ensure that the resulting price remains below the market price.
- 1.30 In case such price regulation elements are introduced in a market mechanism, methods to determine the regulated price references would become as important as in the case of the ARENH mechanism.

⁸ Article L337-14 of the Energy code.

F Lessons for Greece

- 1.31 We derive several lessons from the French experience and the economic theory about regulatory mechanisms for access to wholesale base-load energy. We highlight the critical elements of such mechanisms for application in Greece.

A regulated wholesale mechanism to induce retail competition

- 1.32 In theory, similar products, even though provided by different technologies, should be priced similarly. Such uniform pricing in the wholesale market allows reflecting the actual value of the service provided, which gives the right incentives for market participants to invest (in terms of technologies and quantities).
- 1.33 On the retail side, in a competitive environment and in absence of any retail price regulation, retail prices are established with reference to the wholesale electricity price. In this situation, an alternative supplier should be able to compete with offers of other existing supplier(s) with no need for a regulatory intervention in the wholesale market.
- 1.34 Presence of regulated retail tariffs may create significant barriers for development of retail competition, especially if these tariffs are set below the market price even if only for certain customer segments. Therefore, the most efficient way to stimulate retail competition is to remove regulated retail tariffs that may keep the tariffs below the market price, or at least to ensure that they are cost-reflective.
- 1.35 In France, the ARENH mechanism was partly justified by the willingness to maintain regulated tariffs for most customer segments. If in Greece there is willingness to progressively phase out any remaining explicit or implicit retail price regulation, then there would be little need for a regulatory mechanism in the wholesale market. Such mechanism could be justified only as a transitory measure pending the phase-out of explicit or implicit retail price regulation.
- 1.36 Development of retail competition can be further impeded if the historical operator benefits from significant and sustainable cost advantage because of exclusive access to specific assets that cannot be replicated by alternative suppliers. In this case, even if there is no retail price regulation, the historical operator may offer retail prices that alternative suppliers would find difficult to compete with, without making losses.
- 1.37 The regulator may want to introduce wholesale regulation mechanism allowing alternative suppliers to source power at a price comparable to the cost of the historical operator. For such mechanism to help developing retail competition, the cost advantage of the historical operator must first be established based on a reliable methodology. That is, a difference between the incumbent's full cost of production and the market price (both in €/MWh), should be demonstrated. Technologies with low variable costs usually have high capital costs. Therefore, even though the low variable costs may give the impression of a cost advantage, taking into account actual total costs may lead to different conclusions, as it has been shown by the debate on the ARENH price.

- 1.38 The sustainable nature of the cost advantage of the historical operator should also be established based on the existing regulatory barriers preventing independent suppliers from building lignite and hydro assets. Whereas nuclear generation in France is regulated and requires specific authorisation, it appears that in Greece, any independent energy company is allowed to build lignite and hydro plants following standard procedures.
- 1.39 A sustainable cost advantage could justify a transitory price-based wholesale regulation during the period this cost advantage exists. If this is the case and assuming that critical parameters of the regulation (e.g. price) are defined adequately, a mechanism envisaged by RAE could give alternative suppliers a better opportunity to compete in the retail market.

Volume-based and price-based regulated mechanisms

- 1.40 An important high-level choice of approaches consists in opting either for a volume-based or a price-based regulatory mechanism to enhance competition in the retail electricity market. The French experience presents an example of each of the two regulatory mechanisms:
- **A regulated volume-based mechanism**, of which the example is the VPP auctions implemented in France from 2001 until 2011, only sets the volumes of the regulated product to be allocated. The auction mechanism allocates the products to those who value them the most and determines the price that reflects the willingness to pay of the participants for the product. As it was observed in VPP auctions in France, the auctions result in prices reflecting the market value of the products. Therefore, if there is any cost advantage of the historical operator, it is difficult to transfer it to the alternative suppliers using the volume-based mechanism. Nevertheless, this approach may have a positive impact on competition as it facilitates entry into the market and access to energy and improves liquidity of certain forward products.
 - **A regulated price-based mechanism**, of which the example is the ARENH implemented in France since 2011, sets both the price and volume of the regulated products. Its objective is to transfer the cost advantage of specific assets controlled by the historical operator to alternative suppliers and customers, in case there is such cost advantage. A regulated price-based mechanism is a more complex regulatory intervention and confronts the regulator with the difficulty to set the price as well as the need to set strict limits on the volumes that each supplier can access through the mechanism.
- 1.41 RAE proposal envisages fixing in advance either the price of the regulated wholesale products, or a narrow range of prices for these products. Then, RAE proposal potentially envisages allocating the available volumes of base-load products through price auctions.

- 1.42 As long as the price is capped below the market price, the auction price will likely reach the price cap and the demand will likely exceed the volumes available in the auction. Thus, the price-capped auction mechanism would not yield the two main objectives of the auctions: revealing the market value of the product and ensuring efficient allocation of the product. To allocate the product, the price-capped auctions must be accompanied by a non-market-based allocation mechanism. Such hybrid allocation would unnecessarily complicate the mechanism and create distortions.
- 1.43 In case the Greek regulator favours the price regulation approach, then there would be no need to allocate products through auctions, as demonstrated by the example of ARENH mechanism in France. However, as discussed below, strict limits need to be implemented on the volumes that buyers can access through this mechanism. On the other hand, an auction is an efficient tool for the allocation of products and to discover the product price in case of a volume-based regulation with no limitations on the price.

Critical elements of the price-based regulatory mechanism

- 1.44 Should there be a decision in Greece towards the price-based regulation, then there are a number of elements specific to this regulation, that need to be taken into account very carefully. The analysis of the French ARENH experience allows us to identify a few key aspects that need to be carefully addressed:
- **Fair compensation of the historical operator.** To minimise distortions introduced by the mechanism of regulated access to the base-load wholesale products, the regulated price of these products should be set at the level that would provide the historical operator a fair compensation for the energy produced. In particular, this price should cover full costs of electricity production from the base-load plants, including a reasonable rate of return on the past and future required investments and a reasonable return on investment.
 - **Careful definition of the methodology to compute costs.** The French debate on ARENH has demonstrated the difficulty of determining accurately the historical costs of partly amortised plants. The key issue for the regulator is not only the asymmetry of information and access to the relevant cost data. A more important issue could be to define a fair methodology to account for past and future capital expenditures. Different accounting approaches can lead to very different results, using the same cost parameters.

- **Preventing adverse arbitrage incentives through volume constraints.** Wholesale products allocated to buyers below market price create strong incentives to derive speculative profit from the mechanism, buying energy at a low regulated price and reselling it at a higher wholesale market price. This arbitrage does not contribute to development of retail competition and does not benefit the end-consumers. To prevent such adverse arbitrage incentives, a price-based regulation mechanism needs to be accompanied by strict limits on the volumes that a supplier can access through the mechanism. Furthermore, to ensure that the mechanism helps developing retail competition, these volume limits need to be strongly linked with the effective retail customer load of this supplier. The ARENH mechanism in France provides an example of such volume limits with a strong link with customer load verified ex-post.

Recommendations for the mechanism in Greece

1.45 Based on the above, we suggest the following recommendations for the regulatory mechanism in Greece:

- **Demonstrate the need for regulatory intervention:**
 - A prerequisite to stimulate retail competition is either to remove elements of explicit or implicit regulation that may maintain the retail tariffs below the market price, or to ensure that the retail tariffs are reflective of the full costs. If this prerequisite is met, implementation of a wholesale regulatory mechanism to accompany development of competition becomes less necessary and may be justified only as a transitory measure.
 - If there is sustainable cost advantage of the historical operator due to the access to a specific asset that is not replicable by alternative suppliers, a wholesale regulatory mechanism can be considered as a means to help developing retail competition. An independent third party needs to audit the costs of lignite and hydro production to demonstrate presence and magnitude of the cost advantage of PPC. It also needs to be analysed whether alternative suppliers are unable to access lignite and hydro assets themselves.⁹
 - A retail market monitoring process should be implemented to analyse the evolution of the retail market over time and the contestability of PPC retail tariffs.
- **Determine the approach for regulatory intervention:**

⁹ Whereas nuclear generation in France is regulated and requires specific authorisation, it appears that in Greece, any independent energy company is allowed to build lignite and hydro plants following standard procedures.

- There are different approaches to regulate the wholesale market with their advantages and disadvantages. The optimal mechanism design depends on a clear definition of the objectives of the regulatory intervention.
 - In general, a volume-based regulation, i.e. through an auction approach without price caps, should be privileged. Such approach reveals the market value of the product and efficiently allocates the product to those who value it the most. It is also easier to implement than the price-based regulation.
 - Nonetheless, if a sustainable and non-replicable cost advantage of the historical operator has been demonstrated, price-based regulation may be envisaged. In such a case, allocation through auctions may not be efficient, but many other implementation issues need to be carefully designed as described below.
 - In any case, it is important that the design of a regulatory mechanism takes into account the upcoming changes in the wholesale market structure (e.g. new capacity payment mechanism, etc.) when designing the regulatory mechanism and ensures consistency with them.
- **Address carefully implementation issues:**
 - If a price-based regulation is chosen, the regulated price should be carefully determined so that PPC receives a fair remuneration of the costs of power generation from its base-load assets, taking into account a reasonable rate of return on the past and future required investments, while allowing alternative suppliers to procure power at a competitive price in order to make competitive retail offers.
 - An important aspect is a choice of the accounting methodology to account for past and future capital expenditures. Past experience with the French mechanism may provide important lessons in this respect.
 - A process should be established to monitor the consumption of the customers' of alternative suppliers and to adjust the volume requests with respect to this consumption. This element is crucial to ensure the mechanism helps developing competition with benefit to customers and does not only create transfers between the historical operator and the alternative suppliers.
 - A central counterparty, such as the power exchange, the TSO or a public (financial) institution, should be established to manage financial flows and protect market participants – both retailers and PPC – from payment default and financial risks, as well as to preserve confidentiality of information on competitors.

Section 2

Introduction

A Background

- 2.1 In principle, the Greek power market is under gradual liberalisation since 1999. Over the past years, liberalisation has developed competition on the generation side. Independent power producers entered through construction of CCGT and RES power plants, while base-load lignite and hydro assets have remained under control of the incumbent company PPC.
- 2.2 Furthermore, the retail market has remained highly concentrated. Although alternative suppliers have gained market shares in Small and Medium industrial customer segments by 2012, the crisis and recent bankruptcies of alternative suppliers have increased PPC's market share in the retail market over 98% in 2013.
- 2.3 Greek authorities, primarily the energy regulator RAE, are considering options to stimulate competition and to create a favourable environment for entry of alternative suppliers. In particular, RAE envisages introducing a regulatory mechanism allowing independent retail suppliers to access the base-load lignite and hydro energy from PPC, similar to the access to the historical nuclear energy (ARENH) in France under the "loi NOME".¹⁰
- 2.4 RAE has put forward for consultation a proposal on this regulatory mechanism. Access will be provided through forward auctions where a fixed price or a range of minimum/maximum prices will be defined. Only electricity suppliers will be eligible to participate in these auctions. This ARENH-type mechanism is planned to be transitional and in place for a limited period of time. It will be phased out with completion of privatisation of 30% of PPC's mining, generation and supply business ("Small PPC").

B Objective of this report

- 2.5 For a regulatory mechanism that is envisaged by RAE to help to create retail competition in Greece without creating unnecessary market distortions, such mechanism should meet a number of criteria. In this report we identify these criteria based on the French experience with the similar mechanisms as well as based on the general the economic theory.

¹⁰ RAE, "Τελικές προτάσεις της Ρυθμιστικής Αρχής Ενέργειας για την αναδιοργάνωση της εγχωριας αγοράς ενέργειας", November 2012

- 2.6 We verify whether the RAE proposal meets these criteria. We conclude that a number of crucial parameters of the mechanism proposed by RAE are not defined in sufficient details. Depending on how these parameters are set, the mechanism proposed by RAE could be more or less efficient in meeting its objectives and can create more or less distortions.

c Structure of the report

- 2.7 The rest of the report is structured as follows:
- Section 3 analyses the French mechanism to regulate access to nuclear energy, introduced by the “NOME law.
 - Section 4 analyses the French mechanism to introduce Virtual Power Plant auctions.
 - Section 5 summarises our findings and presents preliminary recommendations on the mechanism to regulate access to lignite and hydro assets for Greece.

Section 3

Mechanism implemented in France in 2011 to regulate access to nuclear energy (ARENH)

A Introduction

- 3.1 The ARENH¹¹ mechanism allows alternative suppliers other than EDF to access nuclear energy at a regulated price. This mechanism is planned to be in place for 15 years.
- 3.2 EDF, the former monopoly, has then to sell a pre-defined part of his nuclear generation to its competitors at a regulated price. The price of the ARENH has already been set at 42 €/MWh since 2012 but its value has been questioned by both EDF and the alternative retailers.
- 3.3 In this section we present the mechanism in details:
 - First, we explain the context and the main principles of the mechanism, including the opinion from the Competition Direction of the European Commission (DG COMP);
 - Second, we describe the observed impact of the mechanism on competition and the market.

B Context and principles of the mechanism

Context

- 3.4 In 2006, the European Commission sent a reasoned opinion to France because of incorrect transposition of the 'electricity' directives. More specifically, the EC criticised the regulated tariffs for eligible customers¹², *i.e.* for industries and professionals, especially in a context where these tariffs were significantly below market prices. The regulated tariffs for large and medium-sized companies were also subject of an investigation procedure for State aid in June 2007¹³.

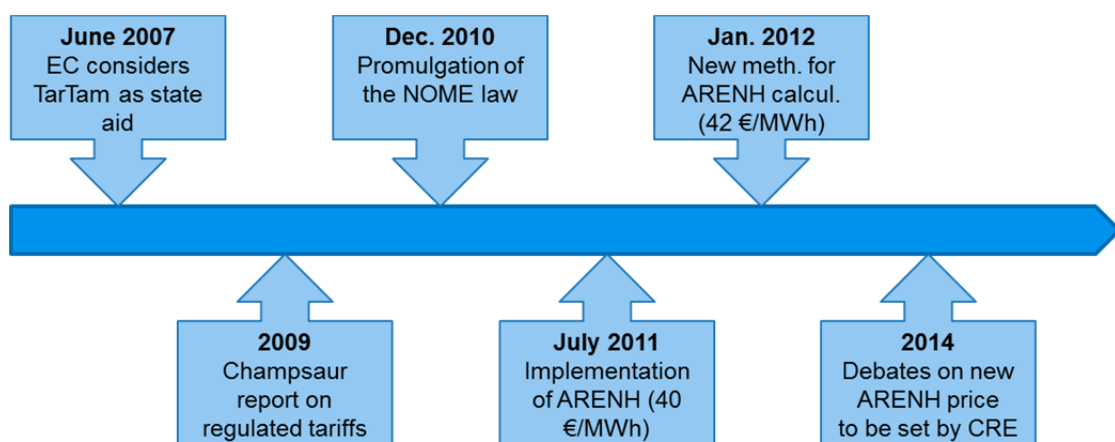
¹¹ ARENH stands for « Accès régulé à l'énergie nucléaire historique ».

¹² IP/06/1768

¹³ IP/07/815 and IP/09/376

- 3.5 In reaction to this, the French government appointed a committee chaired by Paul Champsaur to come up with suggestions for a wholesale market reform¹⁴, with the following mandate:
- i. to ensure that competition introduced in the retail electricity sector benefits of consumers and serve the competitiveness of the French economy;
 - ii. to maintain control of electricity prices, taking into account French commitments with regard to the Union and the emergence of an internal energy market; and
 - iii. to define the role of the electricity market for energy supply in France and Europe.
- 3.6 The committee had to reconcile two contradictory objectives. On the one hand, French consumers should continue to benefit from the advantages of “historical nuclear power” investments which they partially financed. On the other hand, to comply with the European Directives and the spirit of liberalization, new entrants in the retail market should be able to compete with the incumbent EDF and gain market shares.
- 3.7 Indeed, regulated retail tariffs existing in France at that time have raised specific concerns for the development of competition in the retail market¹⁵. They were too low to allow alternative retail suppliers to offer competitive retail prices if they procure wholesale energy from their limited generation portfolio and the wholesale market (lack of “contestability” of tariffs).
- 3.8 The ARENH mechanism was one of the solutions proposed by the committee and have been introduced through the law on the new organisation of the electricity market, known as the NOME¹⁶ law, published in December 2010. This mechanism was implemented in July 2011. Figure 1 below accounts for the main steps of the process followed to establish and adapt the ARENH mechanism.

Figure 1: Process for the establishment of the ARENH mechanism



¹⁴ Lettre de mission du 24 octobre 2008

¹⁵ http://www.assemblee-nationale.fr/13/dossiers/marche_electricite.asp#ECRCM

¹⁶ NOME stands for « Nouvelle organisation du marché de l'électricité ».

Critique of the ARENH mechanism

3.9 The work of the Champsaur commission was aimed at achieving two overarching and somewhat contradicting objectives: a) keep the energy bills of French customers low reflecting the benefits of historical nuclear investment and b) create favourable environment for development of retail competition. The mechanism proposed by Champsaur that on the one hand maintained the regulated tariff for household customers and on the other hand introduced a regulated access to the base-load wholesale production (ARENH), was met with a great deal of scepticism by prominent European energy economists.¹⁷ They considered that the combination of these two mechanisms, and most importantly, the ARENH mechanism, is not the best approach to meet the overarching objectives.

- First, regulated access to facilities is a typical measure introduced in case of natural monopolies, such as transmission networks in the electricity market. In case the facility is not a natural monopoly or an essential facility (which is the case of generating assets), forced access is considered a very complex and risky regulatory intervention.
- Second, the academic experts have found that the ARENH mechanism may create potentially a very dangerous precedent because it sets a low standard in justifying introducing regulated access. As a result, regulated access to facilities that are neither natural monopolies nor essential facilities could be used in other countries or in other industrial sectors. This could be done in various economic situations, for example, to grant a country's population an advantage stemming from the local endowment of natural resource or other historical circumstances. We see this now on the example of Greece.

3.10 Finally, the academic experts point out that the mechanism would have high implementation costs. Cost-reflective price setting would require processing a large amount of information. Furthermore, because of the large amounts of money at stake for the involved parties, EDF and its competitors would have to spend a lot of efforts and money on lobbying and litigations in the discussion of the regulated price.

High level description of the “ARENH” mechanism

3.11 The ARENH mechanism sets the obligation for EDF to sell each year up to 100 TWh of its nuclear production (around 25%) to its competitors at a regulated price. The mechanism is expected to be in place for 15 years. The ARENH energy products are however acquired on a yearly basis.

¹⁷ See for example Crampes, Glachant, et al. 2009 “Academic opinion of economic scholars on Champsaur Commission's paper”

- 3.12 The price should be defined in order to ensure a fair compensation of EDF. Initially, and for a transitory period of 3 years, the Ministry was responsible to set the price. The price was initially established at 40 €/MWh for the 2nd semester 2011, and it has been fixed at 42 €/MWh since 1 January 2012. Since December 2013, it is up to the French energy regulator, CRE, to set the price, which may then be approved or rejected by the Ministry. As long as no decision is taken, the price of 42 €/MWh remains valid. To set the price, CRE should apply a methodology defined in a decree, which has not yet been published.
- 3.13 Rules for attributing ARENH rights in principle aim to allow alternative suppliers to benefit from nuclear energy in a similar proportion to EDF: the share of ARENH in their portfolio should therefore reflect the share of nuclear in electricity generation in France, i.e. around 80%. The distribution of ARENH rights among suppliers depends on their customers' consumption during hours of low national consumption. These rights are calculated in a transparent and non-discriminatory way.
- 3.14 The exercise of the right to ARENH is done by a framework agreement signed by each alternative retailers and EDF. The forecasts and the payment specifications are only known by the regulator and an independent public bank institution (Caisse des dépôts et consignations – CDC) has been appointed to manage the payments and act as a central interface.

Methodology to establish the ARENH price

- 3.15 The methodology to establish the ARENH price, and in particular the costs to be considered, has been, and is still, intensely debated. While the objectives of the law were (i) to allow the development of competition in the retail market and (ii) to make sure French end-consumers ultimately benefit from the “nuclear advantage”, one of the concerns of the Government was to fairly cover EDF's costs and to maintain its financial capability to invest in France to extend the life expectancy of nuclear power plants and/or to prepare for the renewal of the generation park.
- 3.16 The NOME law provides that “to ensure fair compensation to EDF, the ARENH price, reviewed yearly, is representative of the economic conditions of electricity generation by historic nuclear power plants on the period of the measure”¹⁸. It should take into account:
- Capital return on past non amortized nuclear investment, including dismantling;
 - Operating costs of the 58 nuclear reactors in operation before the entry into force of the NOME law (fuel, salaries, taxes);
 - Maintenance costs and future investments necessary for life extension from 40 to 60 years of the existing nuclear park; and
 - Estimated costs of long-term charges such as nuclear waste management.

¹⁸ Article L337-14 of the Energy code.

- 3.17 Thus, the NOME law explicitly excludes from the ARENH price the cost of nuclear asset replacement, while including investments for refurbishment and life expectancy extension.
- 3.18 Different methods were proposed and assessed, giving values ranging from 32 to 90 €/MWh.¹⁹ Principles fixed in the law have allowed to narrow down the scope of the envisaged methods and the resulting price range. But as the current debates on the review of the price show, the stakes remain significant.
- 3.19 So far, the method used is the one proposed by the Commission Champsaur: it has led to a price of 42 €/MWh, including potential costs due to more stringent safety regulation following the Fukushima disaster. However, the President of the French regulator, Mr. de Ladoucette, has recently announced that the application of this method will lead to an increase of 10% of the ARENH price (*i.e.* around 46 €/MWh)²⁰. On the one hand, EDF claims for a higher value (46-50 €/MWh,²¹ or even 55 €/MWh,²² if an economic approach is used, as requested by EDF). On the other hand, alternative suppliers and consumers' association such as UNIDEN require a reduction of the price to follow the decrease of wholesale prices, suggesting values around 37-38 €/MWh²³, or even 30 €/MWh²⁴ to preserve industrial competitiveness. Indeed, French forward base-load prices have fallen to 42-43 €/MWh following the decrease of prices in Germany. Above such a price, the ARENH mechanism would thus be useless.

Technical features of the mechanism

- 3.20 Technical features of the mechanism are explained into more details in Appendix B. A few key elements are worth mentioning:

¹⁹ See more details on the debated price calculation methods in Appendix A.

²⁰ Audition of Philippe de Ladoucette in front of the Parliamentary Commission on nuclear energy costs: http://www.assemblee-nationale.fr/14/cr-cenucleaire/13-14/c1314002.asp#P6_620

²¹ http://m.lesechos.fr/redirect_article.php?id=0201846646525

²² Audition of Henri Proglio, CEO of EDF, in front of the Parliamentary Commission on nuclear energy costs: http://www.assemblee-nationale.fr/14/cr-cenucleaire/13-14/c1314059.asp#P6_591

²³ Audition of Fabien Choné, President of the ANODE, an association representing alternative suppliers, in front of the Parliamentary Commission on nuclear energy costs: http://www.assemblee-nationale.fr/14/cr-cenucleaire/13-14/c1314056.asp#P7_728

²⁴ Audition of Jean-Philippe Bucher, CEO of FerroPem, a large industrial consumer, in front of the Parliamentary Commission on nuclear energy costs: http://www.assemblee-nationale.fr/14/cr-cenucleaire/13-14/c1314007.asp#P6_604

- **Limiting alternative suppliers' windfall profits.** Wholesale products allocated to buyers below market price create strong incentives to derive speculative profit from the mechanism, allowing them to buy energy at a low regulated price and to resell it at a higher wholesale market price. This arbitrage does not contribute to development of retail competition and does not benefit the end-consumers. To prevent such adverse arbitrage incentives, the ARENH mechanism limits the volumes of ARENH rights for each supplier. Furthermore, to ensure that the mechanism helps developing retail competition, the ARENH mechanism links these volume limits with the effective retail customer load of this supplier. Alternative suppliers request ARENH rights ex-ante, based on their forecast. However, eligible volumes are verified ex-post based on the actual consumption of their customers during specific off-peak hours. In case of over-requests, the suppliers pay a compensation to align to wholesale prices (neutral for the suppliers and for EDF). , The supplier is penalised if his initial request exceeds the actual consumption over a certain tolerance margin.
- **Management of financial risk.** To preserve confidentiality of information, financial flows are managed by an independent central counterparty, a public banking institution called "Caisse des Dépôts et Consignations" (CDC). To reduce financial risk exposure, alternative suppliers should provide bank guarantees defined by the regulator at 1.5 times of the monthly invoice. This provides also financial security to EDF.

3.21 Such measures are crucial to ensure that the mechanism is fair and robust and actually benefits to end-consumers.

Opinion of the European Commission (DG COMP) on the mechanism

Context and official opinion of the Commission

3.22 The Commission has always been quite critical about the electricity market in France, and especially the lack of competition and the regulated tariffs. Indeed, before the introduction of ARENH mechanism in 2009, the Commission was considering that:

- the degree of competition was too low;
- the control of nuclear power plants was giving EDF a significant competitive advantage as their generation costs were well below the electricity wholesale prices; and
- the regulated tariffs for end-users applicable to both companies and households was hindering the development of competition in the retail market, in principles, and most specifically as they were set substantially below market prices.

3.23 As a consequence, the Commission opened:

- an in-depth investigation on regulated tariffs for large and medium-sized undertakings; and
 - an infringement procedure regarding regulated tariffs applicable to companies.
- 3.24 The ARENH mechanism was a solution proposed by the French government in order to preserving the competitive advantage of a cheap nuclear energy benefiting to French consumers (especially industries) while responding to the Commission's concerns. Its announcement and the description of the intended principles were initially welcome by the Commission, as it considered that the reform could have "the potential to appreciably enhance competition on the French electricity market to the benefit of consumers"²⁵.
- 3.25 Following to the procedure, the TARTAM tariffs²⁶ were repealed and, on 12 June 2012, the Commission approved the State aid contained in regulated electricity tariffs for large and medium-sized energy consumers in France²⁷, subject to compliance with certain conditions relating to the reform of the French electricity market, the main ones being:
- introducing regulated access for competitors to nuclear power from EDF's existing nuclear power stations (the "ARENH" scheme) up to a ceiling of 100 TWh,
 - maintaining the ARENH price at its current level of 42 €/MWh pending Commission approval of a methodology to be proposed by France for setting the price, and
 - gradually shifting to cost-based pricing every year after summer 2012 until the regulated electricity tariffs for large and medium-sized energy consumers, known as "green" and "yellow" standard prices, are completely eliminated at the end of 2015.
- 3.26 The ARENH mechanism was therefore perceived positively by the Commission and was even a precondition for keeping regulated tariffs for large and medium-sized energy consumers in France.
- 3.27 The implementation details are certainly crucial. The Commission considered that a method to establish the ARENH price should be elaborated, and that it should be objective and lead to the development of effective competition in the French retail market. The Commission therefore requested the ARENH price to be kept at 42 €/MWh as long as the method was not clearly defined and approved by the Commission.

²⁵ http://europa.eu/rapid/press-release_MEMO-09-394_en.htm?locale=en

²⁶ These are regulated tariffs for large and medium-sized energy consumers, who have previously decided to opt for a non-regulated tariff offer. These were higher than usual regulated tariffs but lower than non-regulated tariff offers. In case large energy consumer tariffs in Greece are lower than the remaining tariffs, a regulated price mechanism such as ARENH will most probably not have any effect on the large energy consumers.

²⁷ http://ec.europa.eu/competition/state_aid/cases/220576/220576_1380996_291_2.pdf

Destination clause

- 3.28 At the stage of debates around the NOME law, many observers have pointed out the potential risk that the ARENH mechanism would violate the European competition law.²⁸ In particular, the European law considers that territorial restrictions in energy contracts, that limit the use and resale of the purchased goods, represent a significant barrier to competition and development of market integration.
- 3.29 The ARENH mechanism does not explicitly prohibit the suppliers buying the base-load energy at the regulated price to resell this energy abroad or from using it to serve foreign customers. However, the mechanism implicitly discourages suppliers from doing so by a) limiting volumes that a supplier can access through ARENH based on supplier's customer base in France and b) by penalising purchases through the ARENH mechanism that substantially exceed this limit.
- 3.30 Thus, although ARENH has no explicit territorial restriction, the system of volume allocations and penalties may be considered as a de facto territorial restriction.
- 3.31 Yet, to our knowledge, there was no action from the European Commission concerning this aspect of the ARENH mechanism.

C Impact of the mechanism on competition and the market

- 3.32 This section analyses the consequences of the mechanism on the electricity market, and especially on the retail market.

Evolution of delivered ARENH volumes

- 3.33 Table 1 below presents the volumes of ARENH actually delivered to alternative suppliers.

Table 1: Delivered ARENH volumes by semester

<i>In TWh</i>	ARENH volumes				
	S2 2011	S1 2012	S2 2012	S1 2013	S2 2013
Small consumers	4.7	5.1	5.2	5.4	5.5
Large consumers	26.2	25.1	25.4	27.5	25.9

Sources: Reports on the functioning of the retail markets²⁹, CRE

- 3.34 During the first year of its introduction, the ARENH mechanism allows the delivery of 61.1 TWh of energy to alternative retail suppliers. The following year, these volumes increased by 4%.

²⁸ See for example, Leveque, F. 2011, France's New Electricity Act : A Potentil Windfall Profit for Electricity Suppliers and a Potential Incompatibility with the EU law, the Electricity Journal, 24-2.

²⁹ <http://www.cre.fr/documents/publications/rapports-thematiques/fonctionnement-des-marches-de-detail-francais>

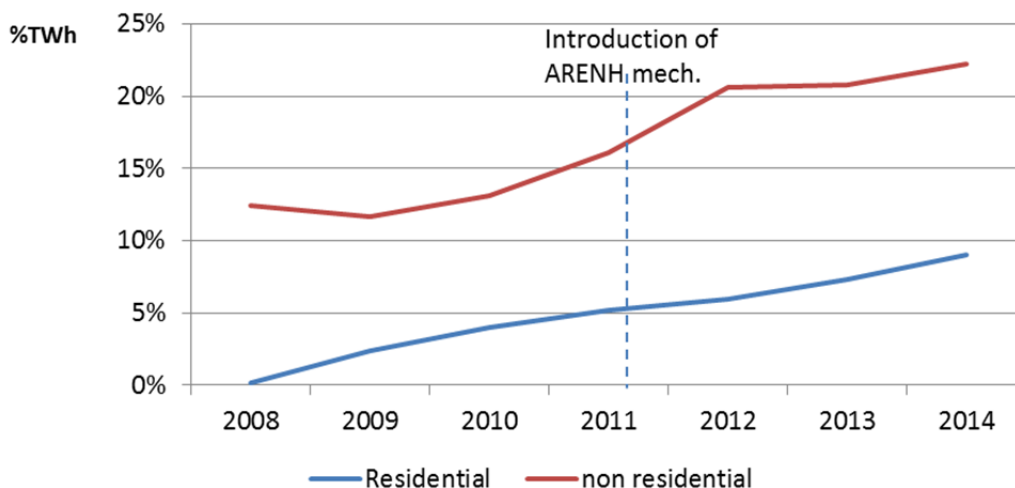
3.35 In 2013, 64.3 TWh were delivered, which represents less than 16% of EDF nuclear generation in France and which is well below the maximum volume of 100 TWh. As depicted above, so far, the bulk of the ARENH volumes has been directed to large consumers (mainly industrials), who stopped benefiting from low regulated tariffs as of July 2011, as competition in the retail market for small consumers has hardly developed yet.

Evolution of retail market shares

3.36 The ARENH mechanism aims to bring competition into the electricity retail market, by providing alternative suppliers with access to nuclear energy, at a regulated price below the wholesale market price. As a result, alternative suppliers should be able to offer retail prices allowing them to compete with EDF's regulated tariff and then gain market shares.

3.37 Figure 2 below reports on the evolution of EDF competitors' market shares from January 2008 to January 2014 for both residential and non-residential sectors.

Figure 2: Market shares of EDF competitors (in energy consumption)



Sources: *Electricity and gas market observatory*³⁰, CRE

3.38 The ARENH mechanism does not seem to have had a significant impact on market share trend neither in the residential nor the non-residential sector. Market shares of competitors in both segments were already in an upward trend. There was a bump in competition development for large consumers right after its introduction, but this effect has not lasted.

³⁰ We used 4th quarter observatory for each year from 2007 to 2013 <http://www.cre.fr/marches/observatoire-et-indicateurs-des-marches>

- 3.39 Current combined market shares of alternative competitors in the residential and non-residential sectors have reached only 9% and 22.2% respectively. After more than two years of existence, the ARENH mechanism has not succeeded in significantly accelerating competition in electricity retail markets. One could argue that, according to the high capital intensity of the electricity sector as well as deeply rooted consumers' habits, market competition in this sector suffers from inertia. In addition, despite the introduction of the ARENH mechanism, especially as regulated tariffs in most of the retail market segments do not cover EDF costs, alternative suppliers were not able to fairly compete, for average consumers in most segments, based on ARENH and wholesale market prices (see next section)³¹.

Evolution of contestability for alternative suppliers

- 3.40 A tariff is contestable if competitors can offer a competitive price, according to their standard costs.
- 3.41 In France, most consumers can still have access to the regulated retail tariffs. Due to the specific energy mix of EDF and the fact that regulated tariffs do not fully cover EDF costs, taking into account its cost of capital, regulated tariffs are hardly contestable: alternative suppliers would not be able to offer a retail price that would be competitive with respect to these tariffs if they buy energy at the wholesale prices. ARENH mechanism aims at giving to alternative suppliers the possibility to compete with regulated tariffs by accessing to the wholesale energy on the same terms as EDF.
- 3.42 To assess the evolution of contestability for alternative suppliers, we split final consumers between those who can benefit from the regulated tariff and others who no longer can (large industrial consumers).

Consumers who benefits from regulated tariff

- 3.43 The French regulator used a pricing model to assess the cost of providing a consumer by using the ARENH mechanism and a complement based on the wholesale market price. The ARENH only helps alternative suppliers to supply base-load demand, but they still need to purchase a part of their electricity on wholesale markets. The supply cost thus depends a lot on the price of electricity on the wholesale market.
- 3.44 Table 2 below presents the gaps between a minimum retail price that an alternative supplier can offer without incurring a loss, and the regulated tariff. These gaps are presented in percentage terms of the regulated price, for different levels of average wholesale prices. A positive value of this gap suggests that a tariff is not contestable.

³¹ Rapport sur le fonctionnement des marchés de détail de l'électricité et du gaz naturel 2012-2013, page 69.
<http://www.cre.fr/documents/publications/rapports-thematiques/le-fonctionnement-des-marches-de-detail-francais-2012-2013>

Table 2: Necessary increases to allow price contestability (as of August 2012)

Wholesale price	48 €/MWh	50 €/MWh	52 €/MWh	54 €/MWh	56 €/MWh
Residential	1.0%	1.4%	1.7%	2.0%	2.3%
Professional	2.2%	2.8%	3.5%	4.4%	4.8%

Source: CRE report on electricity and gas markets based on ERDF data.

- 3.45 The table suggests that despite the ARENH at 42 €/MWh, the regulated tariffs have not become contestable for most of the segments. According to the French regulator (CRE), in August 2012, regulated tariffs should be increased in a range between 1% and 4.8% to be contestable by competitors, depending on the evolution of the wholesale market price.
- 3.46 The magnitude of this difference is comparable to the price increase necessary for the regulated tariffs to actually cover EDF costs. If the regulated tariffs were taking into account the real costs of EDF, alternative suppliers would be able to offer competitive prices. Hence a very important first step to actually boost competition in the retail power market is to ensure that no tariffs are below cost.
- 3.47 In addition, as wholesale market prices are depressed in France and regulated tariffs are increasing (+5% in August 2013 and +5% foreseen in August 2014), the competitive environment is improving.

Large industrial customers who do not benefit from regulated tariffs

- 3.48 Regulated tariffs for large industrial were suppressed when the ARENH mechanism started. It is though possible to assess the effect of the ARENH mechanism compared to the previous regulated tariffs (TARTAM).
- 3.49 Based on the load curve of 100 industrial clients (which accounted for 25 TWh per year) and on the wholesale prices, the French regulator evaluated the effects of the transition between the regulated tariffs and the ARENH³². The average gain is 0.40 €/MWh but differs a lot according to the load profile.

Reduction of alternative suppliers' costs achieved by ARENH

- 3.50 Even though the ARENH mechanism might not have been sufficient to really give a spur to competition in the French market, it has still allowed suppliers to reduce their costs. We have compared the ARENH price with the average year-ahead forward price of electricity in France in 2012 using EEX data. We found that suppliers avoided an average additional cost of 14 €/MWh for base-load electricity.

³² <http://www.cre.fr/documents/publications/rapports-thematiques/fonctionnement-des-marches-de-detail-francais> page 88.

- 3.51 In addition, the average forward price for peak hours was around 70 €/MWh. This also means that ARENH has also enabled a significant gain for alternative suppliers for peak consumption. However, since the overall cost of generating electricity has obviously not changed because of the ARENH mechanism implementation, the above mentioned gains for alternative suppliers are actually losses for the incumbent. This transfer of wealth should not jeopardise the incumbent's viability and creditworthiness.
- 3.52 However, the advantage provided by ARENH is largely reducing as the forward prices have significantly dropped in Germany and consequently in France. With a forward price for yearly base-load products of 43 €/MWh, the actual gain is only of 1 €/MWh, without the risk for over-request and penalties.

Interaction with the future capacity market

- 3.53 Together with the implementation of the ARENH mechanism, the NOME law provides for the introduction of a capacity mechanism in France, based on capacity obligations for suppliers and a decentralised capacity market with bilateral and over-the-counter trading.
- 3.54 In this context, the ARENH mechanism presents an additional value for alternative suppliers as it is likely that ARENH rights will encompass the corresponding capacity certificates³³: suppliers will not only benefit from nuclear energy, but also nuclear capacity in this capacity mechanism, thanks to ARENH. Actually, the ARENH price reflecting the full cost of nuclear generation (both variable and fixed costs included) dispenses the buyers of ARENH products from the obligation to also buy capacity certificates from the market for the corresponding volumes.

D Conclusion of this section

- 3.55 The ARENH mechanism, introduced by the NOME law as a compromise vis-à-vis the Commission to accompany the development of competition while maintaining low regulated retail tariffs. This mechanism provides an interesting example for the discussion in Greece regarding the establishment of a regulatory measure with regard to lignite and hydro assets:
- **The ARENH mechanism was introduced to develop retail competition in a very specific context.** First, it was chosen as an instrument to induce retail competition while maintaining regulated retail tariffs for different customer segments below market prices. Second, it was based on the perceived presence of a cost competitive advantage of EDF's nuclear energy at the time ARENH was introduced.

³³ See the rules for the capacity mechanism functioning proposed by RTE and the accompanying documents: http://www.rte-france.com/uploads/Mediatheque_docs/vie_systeme/annuelles/Mecanisme_capacite/20140409-Regles-Mecanisme-Capacite.pdf

- **The ARENH mechanism so far had a limited impact on the development of competition.** It has reduced supply costs for the alternative retailers, hence allowing them to make more competitive retail offers. Nonetheless, the effect on the competition and the increase of shares of alternative suppliers has remained limited insofar as regulated retail tariffs were kept at a low level, which did not integrally cover EDF's costs, taking into account its cost of capital.
- **Determination of the ARENH price has been a central concern.** The ARENH price should allow EDF to cover its costs with a reasonable margin, while fostering the development of competition. Different methods proposed result in prices ranging between 32€/MWh and 90€/MWh, depending on the economic approach, the asset cost reference and the type of costs to be considered. The implication for EDF and for competitors of this choice is very sensitive. As the ARENH products are yearly, the ARENH price is set on a yearly basis, in principle, taking into account the evolution of the actual nuclear generation cost of EDF. It is important to stress that only approximately 10 €/MWh of the above mentioned full cost of nuclear energy corresponds to variable cost of production, while the remaining 32€/MWh represents various fixed costs (payroll, investment, return on capital etc.).
- **Implementation issues are important.** In particular, the allocation of ARENH rights and the penalty regime allow avoiding freeriding behaviours, which would unduly penalise EDF and undermine the benefits of the mechanism for end-consumers. Well-balanced collaterals and bank guarantees also contribute to the efficiency and the security of the mechanism. In Appendix B below we present the details of such technical features of the ARENH mechanism as the definition of the products, control of the quantities and financial guarantees.

Section 4

VPP mechanism implemented in France from 2001 to 2011

A Introduction

- 4.1 Many governments/regulators have introduced various measures with objectives to help developing competition in the electricity retail sector and to simplify access for alternative suppliers to the wholesale electricity. This section provides case studies of some of such measures, in particular Virtual Power Plants introduced in Europe and especially in France.

B Description of Virtual Power Plants (VPPs) auction mechanisms

Examples of VPPs' implementation

- 4.2 VPP is a requirement or a commitment of the dominant generator to sell off the rights to use plants. In economic terms, VPP auctions are sales of electricity capacity allowing the owner of the plant retains management and control of the plant. However, the energy contracts sold by the owner replicate the output of the plant. VPP may involve a sale of divisible goods of varying durations, offered in periodic open and transparent auctions. VPPs are used as "virtual" rather than "physical" divestiture by dominant firm or firms in a market.³⁴
- 4.3 VPPs have been widely used by regulators in European electricity markets as a tool to promote competition in a context of liberalization of electricity markets with one or more dominant firms. It has been applied either ex-ante (in the context of the merger control investigations), or ex-post (in the context of the investigations of the abuse of dominance). Examples of using VPPs in Europe include:
- **France.** The European Commission requested that EDF sell 5,400MW of capacity in France under VPP auctions as a competition remedy to EDF's acquisition of German utility EnBW in 2001. The Commission considered that by acquiring EnBW, EDF would eliminate a potential entrant into the French market and that the VPP would restore the competitive situation.³⁵

³⁴ Ausubel, L. M., & Cramton, P. (2010). Virtual power plant auctions. *Utilities Policy*, 18(4), 201-208.

³⁵ <http://capacityauctions.edf.com/the-edf-group/capacity-auctions/overview-114023.html>

- **Belgium.** Belgium's incumbent power producer, Electrabel agreed to sell 1,200MW of VPP capacity to actual or potential competitors between 2004 and 2008 in exchange for the approval by the Belgian Competition Council of Electrabel's subsidiary ECS to be the default supplier for the customers of several inter-municipal distribution companies.³⁶
- **Netherlands.** The Dutch Competition Authority NMa required Nuon to offer 900MW in VPP capacity per year over five years as a remedy to the increased competitive position of Nuon as a result of the Nuon/Reliant merger.³⁷
- **Denmark.** In connection with the acquisition of NESA by Elsam, the Danish Competition Authority instructed Elsam to offer a VPP capacity of 250MW in 2006, 500MW of 2007 and 600MW as of 2008.
- **Italy.** In order to bring closure to the investigation into the abuse of dominant position in the wholesale electricity market, Enel agreed to sell 1000MW of VPP capacity in 2007 and 700MW in 2008.³⁸
- **Ireland.** To reduce the dominance of the incumbent generator ESB, the Irish energy regulator required ESB to sell capacity under a VPP.³⁹
- **Czech Republic.** Czech Antitrust Office has required the incumbent generator CE to offer VPP in public auction as one of the conditions for integration of CEZ and several distribution companies.⁴⁰
- **Germany.** E.On and RWE separately have decided to run voluntary VPP auctions in Germany.⁴¹

4.4 For the rest of this section, we will focus on the example of the VPPs' auctions organised in France.

³⁶ <http://www.icis.com/heren/articles/2003/09/12/9273662/electrabel-announces-vpp-auctions.html>

³⁷ Hüschele, K. (2009). Competition Policy Analysis—An Integrated Approach (pp. 11-212). Physica-Verlag HD, p. 367

³⁸ <http://www.icis.com/heren/articles/2007/01/02/9292897/italian-enel-sells-1000-mw-of-2007-vpp-no-date-set-for-2008.html>

³⁹ CER (2005): Sixth Virtual Independent Power Producer (VIIPP6) Auction. Commission for Energy Regulation, Decision Documents.

⁴⁰ CEZ (2006): CEZ's Virtual Power Plant Auction Within the Framework of the Regional Power Market Development. Press conference ČEZ, a. s., Hotel Palace, 25.7.2006.

⁴¹ Maurer, L., & Barroso, L. A. (2011). Electricity auctions: an overview of efficient practices. World Bank Publications.

Description of VPPs' auction mechanism used in France

Context

- 4.5 In 2000, the European Commission was notified of a proposed concentration whereby EDF and OEW, an association of 9 public districts in the Southwest of Germany, would acquire joint control on EnBW, the 4th main electricity utility in Germany. This proceeding followed a tender organised by the Land Baden-Württemberg, which would increase EDF's share in EnBW to 34.5%.
- 4.6 Pursuant the Treaty establishing the European Community and the Council Regulation on the control of concentrations, the Commission analysed the case and declared the concentration to be compatible with EU rules, provided the full compliance of the concerned undertakings with their commitments⁴². Within these commitments, EDF offered to make available to competitors access to 5,400MW generation capacities located in France in the form of virtual power plants' auctions.
- 4.7 The mechanism was initially foreseen for duration of 5 years. After the 5 year period, the Commission had the possibility to decide to extend EDF's obligation to grant access to generation capacity. The mechanism was terminated in 2011, as EDF resold its shares in 2011 and no longer exercises control on EnBW⁴³.
- 4.8 A trustee was to be designated in order to monitor the parties' compliance with the terms of the Commission undertaking in a manner consistent with its purpose.

Functioning of the VPPs in France

- 4.9 The VPPs comprise 4,400 MW of base-load and 1,000 MW of peak-load. This capacity can be acquired by generators, suppliers and traders already operating in France and by those who wish to enter the market, through quarterly auctions conducted on the internet. The auctions were organised from September 2001 to November 2011.
- 4.10 EDF offered this generation capacity in the form of option contracts specifying both an energy price and a capacity price. The energy price is fixed in advance and remains fixed for the duration of the contract (strike price). Energy prices are fixed by EDF after having given the trustee the occasion to verify their level. They are determined before each auction based on the variable costs of nuclear power for base-load products and on fuel costs and peak power plants' characteristics for peak products.

⁴² http://ec.europa.eu/competition/mergers/cases/decisions/m1853_en.pdf

⁴³ http://encherescapacites.edf.com/fichiers/fckeditor/File/Encheres/DecisionCE_Fin_VPP_301111.pdf

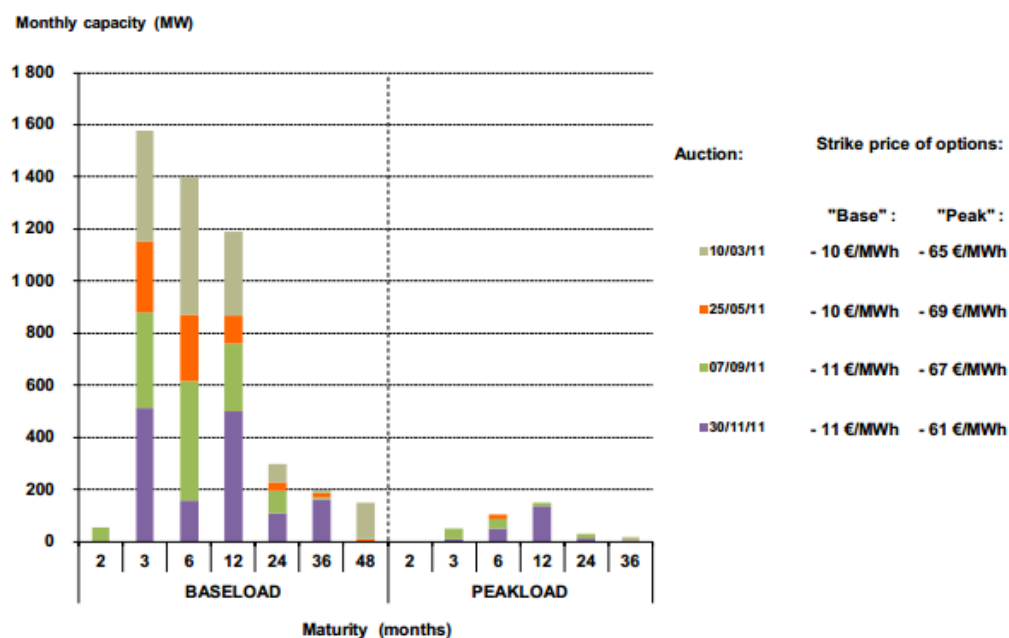
- 4.11 The capacity price is determined by the auction mechanism. This capacity price is to be paid every month for each MW purchased, for the duration of the contract. Bids were grouped according to plant type disregarding the length of the contract. Within each group, bids were sorted in descending order according to their spread in relation to a reference value set by EDF in order to facilitate the bidding process. The reference value reflected EDF's estimates of the French wholesale power market. The reference value is not a reserved price and spreads may be negative. Reference values were communicated to and examined by the trustee before the invitations to bid are announced.
- 4.12 If the trustee testified that the prices of the auctions are abnormally low in relation to market prices or that the auctions result in bids significantly below EDF's costs, the Commission, upon reasoned request by EDF or the trustee, will decide whether, and for what period, the fixing of a reserved price is appropriate. In agreement with the trustee, further auctions may be suspended until the Commission has taken a decision.
- 4.13 Therefore, the buyers of these options have a drawing right on EDF generation capacity at a pre-defined variable cost, without having to assume all of the engineering and operational risk of plant ownership. Thus, the name of VPP (Virtual Power Plant) was given to the products sold.
- 4.14 The only difference between the two types of products offered – base load VPP and peak load VPP – is the energy price. Both base load and peak load VPPs are offered in a variety of durations from 3 to 36 months. In addition the base load VPP is available as a 48 month duration product.
- 4.15 The auctions are being conducted as multi-round ascending price clock auctions offering all products simultaneously (3, 6, 12, 24, 36 and 48 months for base load VPP and 3, 6, 12, 24 and 36 months for peak load VPP), to facilitate buyers acquiring the appropriate portfolio of contracts for their needs.

Results of the VPPs auctions

- 4.16 At each auction, around 30 energy players were competing and typically around 20 of them emerged as successful purchasers. The volume EDF has made available to competitors was representing approximately 40 TWh per year.
- 4.17 The strike price for base products remained stable during the whole period, between 9 and 11€/MWh. On the other hand, the strike price for peak products, which depends more on fossil fuel prices, was more variable. For instance, it has varied between 61 and 69 €/MWh in 2011, and has even reached 101 €/MWh⁴⁴ depending on the considered auctions. Figure 3 shows volumes acquired and strike prices for 2011 VPPs' auctions.

⁴⁴ <http://www.cre.fr/marches/marche-de-gros/rapports-de-surveillance>

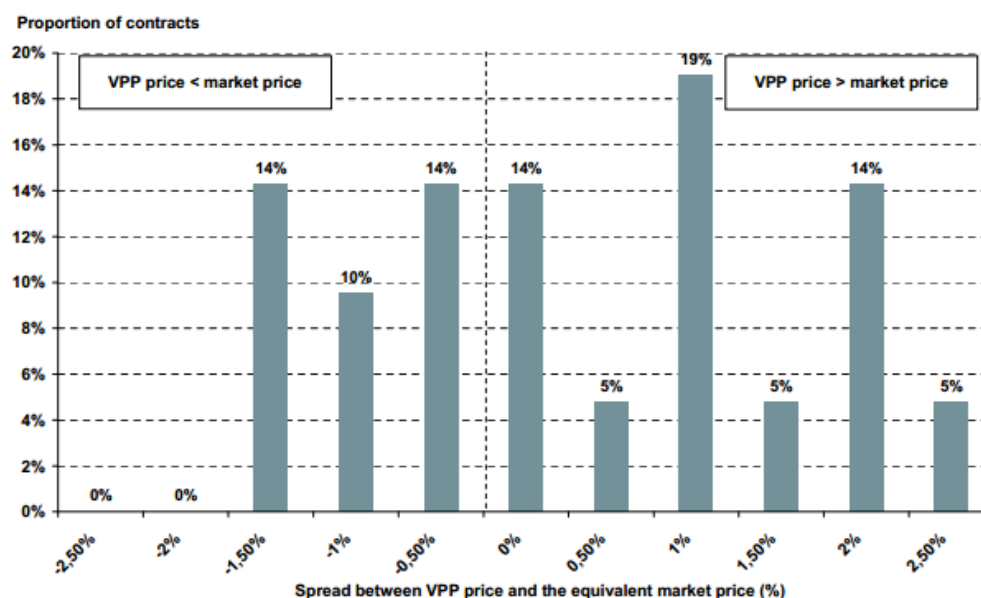
Figure 3: Contracted volumes in 2011 VPPs' auctions



Source: EDF, CRE report on wholesale market functioning 2011-2012

- 4.18 The VPPs' auctions were usually not highly concentrated. For instance, from January 2010 to June 2011, the highest market share, all maturities considered, was 23% for base products and 26% for peak products. The Herfindahl–Hirschman Index was, at the highest, of 901 for base products and of 1465 for peak products.
- 4.19 Due to the low strike price of the base products, the optionality of base products was rarely used: day-ahead prices in France were above 10€/MWh 99.4% of the time in the first semester 2011 and above 11€/MWh 96.8% of the time in the second semester 2011. Consequently, the gap between the auction value and futures/forwards prices was on average only -0.004%, with a standard deviation of 1.3%, as it is shown in Figure 4.

Figure 4: Difference between the auction price of the VPP base products and prices of equivalent products quoted on EPD France



Source: EDF, CRE report on wholesale market functioning 2010-2011

4.20 Thus, due to the reasonably high level of competition, VPP prices have reflected market conditions more than EDF's costs. As a result VPPs were not substantially reducing costs for alternative suppliers.

C Conclusion of this section

4.21 The VPP mechanism was implemented for 10 years in France, and many market players (around 30 each time) took part in the auctions.

4.22 The products allocated through the mechanism were options to buy energy at a certain strike price. However, low strike price for the base-load products (around 10 €/MWh) made these products effectively equivalent to standard forward base-load products traded in the markets. Prices for the base-load VPP products set in the auction were also very similar to the market prices of standard base-load forward products.

4.23 Although EDF's competitors were not benefiting from lower prices thanks to VPPs in general, it was useful for them to get access to base-load energy. The mechanism has stimulated the liquidity of the forward market and facilitated hedging for new entrants, especially new retailers.

- 4.24 VPPs in France did not include explicit regulation limiting the price. However, it is possible to foresee either a price floor – in order to make sure at least the costs of the seller are covered – or price cap – in order to guarantee a minimum transfer of cost advantage, if any, to the buyers. However, the latter may distort the well-functioning of the auction process, which is supposed to give the actual market value of the product. If the price cap is low, it is likely that at this price the demand would exceed the supply, and therefore the price cap would be systematically reached. The VPP auction would therefore act as a price-regulated mechanisms, where the allocation of the scarce regulated product could have been done through mechanisms other than auctions, such as pro-rata.

Section 5

Conclusions and recommendations

5.1 In this section we derive conclusions about regulatory mechanisms for access to wholesale base-load energy from the French examples and the economic theory. We further highlight the critical elements of such mechanisms for application in Greece:

- First, we discuss a general market context, which may justify introduction of a form of wholesale regulation to induce development of retail competition;
- Second, we highlight the important choice between the volume-based and price-based regulatory mechanisms;
- Third, in case the preference is made towards the price-based mechanism, we identify main critical elements of such mechanism; and
- Finally, we provide specific recommendations for the development of the regulatory mechanism in Greece.

A A regulated wholesale mechanism to induce retail competition

A market situation with no retail price regulation

5.2 In theory, similar products, even though provided by different technologies, should be priced similarly.

5.3 In the wholesale market, a unique energy price obtained by all generating plants would lead to optimal long-term incentives to maintain and invest in the production mix. In particular, base-load plants, such as nuclear, large hydro and potentially lignite plants, are characterised by low variable cost of energy production. Under a unique marginal electricity price, these plants obtain a high infra-marginal rent. This infra-marginal rent should allow these plants to recover the high capital costs of these assets.

5.4 It is important that receiving high infra-marginal rents by base-load plants is optimal in the dynamic perspective even if the plants are already partly or fully amortised. Such rents are necessary to cover for anticipated refurbishment and maintenance costs, and/or for replacement investment cost for such plants.

- 5.5 On the retail side, in a purely competitive environment and in absence of any retail price regulation, prices at which customers are served at the retail level would reflect the wholesale electricity price plus relevant costs necessary to deliver energy from the wholesale level to the customer (e.g. transmission and distribution charges and supply costs plus supplier's margin).
- 5.6 In this ideal situation, there should be few barriers to entry in the retail market of alternative suppliers. A supplier could procure energy at the wholesale market price and be able to offer a retail price that could compete with retail offers of other existing suppliers. No regulatory intervention would be required at the wholesale level to help developing retail competition.

A market situation with retail price regulation

- 5.7 Retail competition becomes more difficult to introduce in presence of price regulation at the retail level. This is particularly the case if the retail tariff provided by the incumbent operator is set below the market price. In this case, alternative suppliers would not be able to offer competitive retail prices without making a loss, if they procure energy at the wholesale market price.
- 5.8 Regulated retail tariffs set below the cost of the historical operator for some customer segments at the expense of other customer segments may create further problems in development of retail competition:
- It may be impossible for alternative suppliers to enter the low-price segments without incurring a loss;
 - It may be possible for alternative suppliers to enter the high-price customer segments. However, financial viability of the historical operator may crucially depend on the relative size of the customer segments cross-subsidising each other in his customer base. As a result of the loss of the high-price customers to the alternative supplier, the historical operator may suffer financial difficulties, unless the retail tariffs are continuously revised.
- 5.9 The most efficient way to stimulate retail competition is to remove regulated retail tariffs that may keep the tariffs below the market price, or at least to ensure that they are cost-reflective. In France, the ARENH mechanism was partly justified by the willingness to maintain regulated tariffs for most customer segments. If in Greece there is willingness to progressively phase out any explicit or implicit retail price regulation, the need for a regulatory mechanism in the wholesale market could be justified only as a transitory measure.

Ensuring a level playing field through the wholesale regulation

- 5.10 Development of retail competition can be further impeded if the historical operator benefits from significant and sustainable cost advantage because of exclusive access to specific assets that cannot be replicated by alternative suppliers. This usually happens when:

- the total costs of electricity production from these specific assets is below the wholesale market price; and
 - the access to the specific assets is restricted to the historical incumbent (e.g. if it benefits from exclusive operation of a certain technology. For example, currently EDF is the only authorised operator of nuclear power plants in France).
- 5.11 In this case, even if there is no retail price regulation, the historical operator may offer retail prices that alternative suppliers would find difficult to compete with, without making losses. To stimulate retail competition, the regulator may want to introduce a wholesale regulation mechanism that would ensure a level playing field by sharing the cost advantage of the historical operator with its competitors.
- 5.12 For such mechanism to help developing retail competition, the cost advantage should be demonstrated based on a reliable methodology. Technologies with low variable costs usually have high capital costs. Therefore, even though the low variable costs may give the impression of cost advantage, taking into account actual costs may lead to different conclusions, as it has been shown by the debate on the ARENH price.
- 5.13 A sustainable nature of the cost advantage of the historical operator should also be established based on the existing regulatory barriers preventing the independent suppliers from building lignite and hydro assets.
- 5.14 A sustainable cost advantage could justify a transitory price-based wholesale regulation during the period this cost advantage exists. Assuming that critical parameters of the regulation, such as the price, are defined adequately, a mechanism such as envisaged by RAE could give alternative suppliers a better opportunity to compete in the retail market.

B Volume-based and price-based regulated mechanisms

- 5.15 The French experience presents two examples of regulatory mechanisms envisaged to enhance competition in the retail electricity market, of which one is volume-based and the other is price-based. These different mechanisms also had different effects in practice:
- **A regulated volume-based mechanism**, of which the example is VPPs auctions implemented in France from 2001 to 2011, only sets the volumes of the regulated product to be allocated. The auction mechanism allocates the products to those who value them the most and determines the price that reflects the willingness to pay for the product by the market participants. As it was observed in VPP auctions in France, the auctions result in prices reflecting the market value of the products. Therefore, if the historical operator has any cost advantage, it is difficult to transfer it to the alternative suppliers using the volume-based mechanism. Nevertheless, this approach may have a positive impact on competition as it facilitates entry into the market and access to energy and improves liquidity of certain forward products.

- **A regulated price-based mechanism**, of which the example is the ARENH implemented in France since 2011, sets both the price and the volume of the regulated products to transfer the cost competitive advantage of specific assets, if such cost advantage exists. A regulated price-based mechanism is a more complex regulatory intervention and confronts the regulator with the difficulty to set the price, given the asymmetry of information and the complexities and side effects underlying the choice of parameters for the calculation. The price-based regulation also requires the regulator to set strict limits on the volumes that each supplier can access through the mechanism.
- 5.16 RAE proposal seems to include elements of both the volume-based and the price-based regulatory mechanisms:
- On the one hand, the access price or a narrow range of the price of the base-load products is fixed in advance, suggesting elements of price regulation;
 - On the other hand, the RAE proposal potentially envisages allocation of the available volumes of base-load products through price auctions. This is typically an instrument used in volume-based regulation.
- 5.17 Allocation of a scarce product through price auctions is efficient in case there is no price regulation (e.g. a price cap), as was the case in French VPP. The auctions determine the optimal price and allocate the product to those who value it the most.
- 5.18 As long as the price is capped below the market price, the auction price will likely reach the price cap and the demand at this price will likely exceed the volumes available in the auction. To allocate the residual demand for the product, the auctions must be accompanied by a non-market-based allocation mechanism.
- 5.19 Such a hybrid allocation combining a price-capped auction with a non-market based mechanism to allocate the residual demand, will unnecessarily complicate the mechanism, while being less efficient than an auction with no price cap:
- The price will be determined by the price cap and will not reveal the value of the product to the market participants;
 - The product will be eventually allocated through the non-market mechanism and the allocation will not reflect valuation of the product by market participants.
- 5.20 In case Greek regulator favours the price regulation approach, then there would be no need to allocate products through auctions, as demonstrated by the example of ARENH mechanism in France. However, as discussed below, strict limits need to be implemented on the volumes that buyers can access through this mechanism.

c Critical elements of the price-based regulatory mechanism

- 5.21 If there is a strong preference in Greece towards the price-based regulation, then there are a number of elements specific to this regulation that need to be taken into account very carefully. The analysis of the French ARENH experience allows us to identify a few key aspects that need to be addressed.

Fair compensation of the historical operator

- 5.22 To minimise distortions introduced by the mechanism of regulated access to the base-load wholesale products, the regulated price of these products should be set at the level that would provide the historical operator a fair compensation for the energy.
- 5.23 This means that, at minimum, it should cover the full cost of electricity production from the base-load plants (not only variable costs, but also fixed costs), including a reasonable margin for the operator. In particular, this price should be sufficient to cover the reasonable rate of return on the past and future required investments of the base-load plants.
- 5.24 Indeed, this fair compensation should maintain the right incentives for market participants, including the historical operator, and the financial solidity to make the necessary investments in the long-term, whether it is for refurbishment or upgrade.

Careful definition of the methodology to compute costs

- 5.25 The French debate on ARENH has demonstrated the difficulties of determining accurately the historical costs of partly amortised plants.
- 5.26 The key issue for the regulator is not only the asymmetry of information and having access to the relevant cost data, but most importantly to define a fair methodology to account for past and future capital expenditures.
- 5.27 The example of the ARENH mechanism in France has shown that different accounting approaches can lead to very different results, using the same cost parameters.

Preventing adverse arbitrage incentives through volume constraints

- 5.28 Wholesale products allocated to buyers below market price create a strong arbitrage opportunity. In absence of the strict allocation rules, buyers would be able to derive speculative profit from the mechanism, buying energy at a low regulated price and reselling it at a higher wholesale market price. This arbitrage would boil down to a simple transfer from PPC selling the regulated base-load products to buyers accessing these products. It would not contribute to development of retail competition and would not benefit to end-consumers.

- 5.29 To prevent such adverse arbitrage incentives, a price-based regulation mechanism needs to set strict limits on the volumes that a supplier can access through the regulated mechanism. Furthermore, to ensure that the mechanism helps developing retail competition, these volume limits need to be strongly linked with the effective retail customer load of this supplier. The ARENH mechanism in France provides an example of such volume limits with a strong link with customer load verified ex-post. As a result, suppliers who have declared their customers' load above the realised level do not benefit from the regulated access price for the over-estimated volume, and may even be penalised above a certain tolerance margin.
- 5.30 The RAE proposal so far lacks details on the provisions for volume control and possible penalties. Therefore, at this stage, it is difficult to see whether these provisions would create a sufficiently strong link between the allocation of regulated volumes and customer load and would prevent exploiting any arbitrage or freeriding opportunities.

D Recommendations for the mechanism in Greece

- 5.31 Based on the above, we suggest the following recommendations for the wholesale regulatory mechanism in Greece:

Demonstrate the need for regulatory intervention

- A prerequisite to stimulate retail competition is either to remove elements of explicit or implicit regulation that may maintain the retail tariffs below the market price, or to ensure that the retail tariffs are reflective of the full costs. If this prerequisite is met, implementation of a wholesale regulatory mechanism to accompany development of competition becomes less necessary and may be justified only as a transitory measure.
- If there is sustainable cost advantage of the historical operator due to the access to a specific asset that is not replicable by alternative suppliers, a wholesale regulatory mechanism can be considered as a means to help developing retail competition. An independent third party needs to audit the costs of lignite and hydro production to demonstrate presence and magnitude of the cost advantage of PPC. It also needs to be analysed whether alternative suppliers are unable to access lignite and hydro assets themselves.⁴⁵
- A retail market monitoring process should be implemented to analyse the evolution of the retail market over time and the contestability of PPC retail tariffs.

⁴⁵ Whereas nuclear generation in France is regulated and requires specific authorisation, it appears that in Greece, any independent energy company is allowed to build lignite and hydro plants following standard procedures.

Determine the approach for regulatory intervention

- There are different approaches to regulate the wholesale market with their advantages and disadvantages. The optimal mechanism design depends on a clear definition of the objectives of the regulatory intervention.
- In general, a volume-based regulation, i.e. through an auction approach without price caps, should be privileged. Such approach reveals the market value of the product and efficiently allocates the product to those who value it the most. It is also easier to implement than the price-based regulation.
- Nonetheless, if a sustainable and non-replicable cost advantage of the historical operator has been demonstrated, price-based regulation may be envisaged. In such a case, allocation through auctions may not be efficient, but many other implementation issues need to be carefully designed, as described below.
- In any case, it is important that the design of a regulatory mechanism takes into account the upcoming changes in the wholesale market structure (e.g. new capacity payment mechanism, etc.) when designing the regulatory mechanism and ensures consistency with them.

Address carefully implementation issues

- If a price-based regulation is chosen, the regulated price should be carefully determined so that PPC receives fair remuneration of the costs of power generation from its base-load assets, taking into account a reasonable rate of return on the past and future required investments, while allowing alternative suppliers to procure power at a competitive price in order to make competitive retail offers.
- An important aspect is a choice of the accounting methodology to account for past and future capital expenditures. The experience of the French mechanism can provide important lessons in this respect.
- A process should be established to monitor consumption of customers of alternative suppliers and to adjust the volume requests with respect to this consumption. This element is crucial to ensure the mechanism helps developing competition with benefit to customers and does not only create transfers between the historical operator and the alternative suppliers.
- A central counterparty, such as the power exchange, the TSO or a public (financial) institution, should be established to manage financial flows and protect market participants – both retailers and PPC – from payment default and financial risks, as well as to preserve confidentiality of information on competitors.

Appendix A

Determination of the ARENH price

Principles defined in the law

- A.1 For the 3-year interim period, the ARENH price was determined by the Ministry after the regulator's non-binding opinion:
- It was initially set at 40 €/MWh for the 2nd semester 2011, in consistency with the TARTAM. The method aimed to ensure a smooth transition, especially as some contracts for large consumers are fixed for a calendar year. Industrials, which were benefiting from TARTAM tariff until July 2011, when TARTAM was abolished and NOME was implemented for the first time, were given the possibility to benefit from ARENH, possibly through their supplier, resulting in essentially the same price. CRE gave a positive opinion on this price⁴⁶.
 - The price has been set by the Ministry at 42 €/MWh since 1 January 2012. There was some debate on how to calculate and justify this value. CRE had some reservations and gave a negative opinion⁴⁷. The price was though effective despite this negative opinion.
- A.2 Since December 2013, the ARENH price has to be proposed by the regulator to the Ministry, who can accept or reject the proposal. It is planned to review the price each year, but if CRE does not propose any new price or if it is rejected by the Ministry, the previous value remains effective.
- A.3 The NOME law provides that "to ensure fair compensation to EDF, the ARENH price, reviewed yearly, is representative of the economic conditions of electricity generation by historic nuclear power plants on the period of the measure"⁴⁸. It should take into account:
- Capital return on past non amortized nuclear investment, including dismantling;
 - Operating costs of the 58 nuclear reactors in operation before the entry into force of the NOME law (fuel, salaries, taxes);
 - Maintenance costs and future investments necessary for life extension from 40 to 60 years of the existing nuclear park; and

⁴⁶ <http://www.cre.fr/documents/deliberations/avis/avis-sur-le-projet-d-arrete-fixant-le-prix-de-l-acces-regule-a-l-electricite-nucleaire-historique-a-40-mwh-au-1er-juillet-2011>

⁴⁷ <http://www.cre.fr/documents/deliberations/avis/avis-sur-le-projet-d-arrete-fixant-le-prix-de-l-acces-regule-a-l-electricite-nucleaire-historique-a-42-mwh-au-1er-janvier-2012>

⁴⁸ Article L337-14 of the Energy code.

- Estimated costs of long-term charges such as nuclear waste management.

A.4 The NOME law excludes explicitly from the ARENH price the cost of nuclear asset replacement, while investments for refurbishment and life expectancy extension are included. However in the objectives of the NOME law (“exposé des motifs”), it was also mentioned that “the ARENH price is set so that the utilities will find themselves in a sound financial position near the end of life of the historic nuclear plants to be able to contribute to the renewal of capacity in electricity production.” Hence, maintaining EDF’s long term viability and creditworthiness was an important concern of the NOME law and this was taken into consideration when setting the ARENH price.

Envisaged approaches for ARENH price calculation

A.5 To determine the ARENH price, several methods were proposed. The Government appointed a second committee, chaired by Paul Champsaur, to determine the methodology of the ARENH price calculation. The choice of the methodology attracted much debate and the approaches adopted in several studies lead to very different results.

A.6 The price of the ARENH is very sensitive to the chosen methodology; it depends on the general methodological approach and on the interpretation of the characteristics presented in A.3. Table 3 presents different methodologies and their resulting cost estimates.

Table 3: Historical nuclear cost estimates for the period 2011-2025

Methodology	Principle	€2010/ MWh	sources
Cost of new Nuclear (EPR)	Compute the cost of newly built sites with the best available technologies	70-90	EDF ⁴⁹
Current Economic Cost Includes extension life time investment	Compute a rent paid to use the park rather than build it. It means financing a new building of identical production facilities	54,2	Cour des Comptes ⁵⁰
Current Cost Accounting	Especially takes into account the depreciation, remuneration of no depreciated capital and cost increase of replacement	38.2	Cour des Comptes
Champsaur method includes amortized capital and extension of life expectancy investments	Compute the average rent to manage and maintain historic existing nuclear plants in condition until its closing on the period 2011-2025	36-39	Champsaur commission ⁵¹
Consistency with regulated tariffs	Correspond to the implicit current cost of historic nuclear park taken into account in regulated tariffs	32-34	Champsaur commission

Cost to build as new method

- A.7 The first method calculates the price to build and exploit nuclear power plants using the most up-to-date technologies. According to EDF, it leads to a price of 70-90 €/MWh. It was quickly excluded and the Ministry chose to determine the ARENH price based on historic assets; indeed, the Ministry considered that this method was leading to a too high price and was not reflecting current economic conditions to run the nuclear generation park in France.

Current economic cost method

- A.8 The second method, called the current economic cost (CEC), reflects what a supplier will agree to pay to EDF to lease its plants rather than to build them. It includes their renewal at their retirement time. The method consists in the addition of :
- A capital annuity that represents the economic rent;
 - Recorded operating costs (fuel, tax, salaries, central function...); and
 - Future cost linked to the maintenance of the plants (including dismantling cost and waste storage), accounted as fixed assets.

- A.9 In 2009, EDF also made an assessment of the current economic cost and found it to be equal to 46 €₂₀₀₈/MWh. The difference with the Cour des Comptes calculation is due to the

⁴⁹ *Les coûts de la filière électronucléaire* –jan 2012 Cour des comptes page 385.

⁵⁰ *Les coûts de la filière électronucléaire* – jan 2012 Cour des comptes page 283.

⁵¹ « Rapport de la commission sur le prix de l'accès régulé à l'électricité nucléaire historique (ARENH) », March 2011 page 19.

Fukushima safety guidelines and the estimation of the investment needed to extend the life of the plants to 60 years.

- A.10 The CEC is based on the make-or-buy principle. It means that a supplier has to pay a rent to the holder of the plant throughout the life of the asset, and this rent is such as the owner will be able to renew the nuclear assets.

Current cost accounting method

- A.11 The third approach (also used by the Cour des Comptes) is the Current Cost Accounting (CCA) method, it reflects the impact of the monetary erosion while maintaining a cost accounting structure. It involves a renewal of the generation fleet.
- A.12 The CCA method re-evaluates yearly the net accounting value of the fleet taking into account inflation and interim interests: the cost of capital (remuneration and reimbursement) is equal to the addition of the depreciation and the remuneration of the debt and equity. The cost of capital decreases over time in constant money. The yearly re-evaluation of the assets assumes a restitution of the capital at the asset retirement time and thus the possibility to renew asset.

“Champsaur” method

- A.13 The last approach, the Champsaur method, is the one chosen by the government. It uses an economic approach similarly to the CEC, but takes into account the current net accounting value of the assets. This method is described in details in the next section.

Consistency with regulated tariffs

- A.14 The Champsaur commission also estimated the implicit price of nuclear energy from the historic nuclear plants contained in the regulated tariffs. It was evaluated to 32-34 €/MWh in 2011.
- A.15 Insofar as CRE has assessed the regulated tariffs do not cover EDF’s costs⁵², this probably underestimates the actual cost of nuclear generation for EDF. The notion of cost of nuclear is therefore today not equivalent to the implicit price of nuclear energy in the regulated tariffs.

Description of the implemented ARENH pricing methodology

- A.16 The Champsaur method calculates the full cost of the French nuclear fleet, already partially amortized, without taking into account its renewal, i.e. for example it excludes the costs of building the new EPR nuclear power plant of Flamanville.

⁵² Rapport sur le fonctionnement des marchés de détail de l’électricité et du gaz naturel 2012-2013, page 64.
<http://www.cre.fr/documents/publications/rapports-thematiques/le-fonctionnement-des-marches-de-detail-francais-2012-2013>

- A.17 Similar to the CEC, the Champsaur methodology calculates an economic rent. However this rent is based on the current net accounting value, i.e. the residual not yet depreciated investment, and on the specific 2011-2025 period. The price is representative of the production cost of nuclear electricity in the specific context of French nuclear power plants, taking into account the history of the park.
- A.18 In brief, the Champsaur method does not assume the replacement of the assets but it is:
- Based on an economic rent (principle of leasing);
 - Taking into account the state of the assets (depreciated, refurbished...);
 - Providing a fixed cost over the period in constant term;
 - Taking into account the historical refurbishments; and
 - Taking into account the financial impact of life time extension of the assets (scheduled investments).
- A.19 Following this method, the Champsaur commission found a cost between 36 and 39 €/MWh. The CRE validated the Champsaur method and confirmed the previous range.
- A.20 However, finally, the government opted for a political compromise and for a price of 40 €/MWh for 2011 and 42 €/MWh for 2012. It motivated an expected increase of costs due to potential additional investments caused by new safety guidelines post-Fukushima. The government's concern to safeguard EDF's long term financial strength and creditworthiness has probably also contributed to this decision.

Debates around the application of the methodology

- A.21 There was much debate on the remuneration of capital costs. For instance, one of the Champsaur committee – Jacques Percebois – stated that if EDF were to sell nuclear energy to its competitors on the basis of the current economic cost (CEC), EDF would recover twice a large part of the capital cost. This statement was based on the fact that EDF had already amortized a large amount of the investment cost, reimbursed the debt interest and the equity remuneration. According to the Champsaur report, at the release date (March 2011) the nuclear investments which had not being depreciated yet was evaluated at 15 b€ and corresponded to the capital yet to be reimbursed (knowing that debt and equity have already been remunerated)⁵³.
- A.22 The regulator is currently reviewing the method to apply for computing the ARENH price for the next years. In January 2014, CRE's president stated that according to the methodology applied in 2011, the price of ARENH in 2014 should be 10% higher than 42 €/MWh (i.e. approx. 46 €/MWh).

⁵³ *Rapport de la commission sur le prix de L'ARENH présidée par Paul Champsaur*, March 2011 page 13. The depreciation time was set to 30 years. In 2011, the average age of the assets was 26 years.

A.23 However, in the meantime, an association of electro-intensive industrials (UNIDEN) is complaining about the significantly high price of electricity in France compared to the German forward prices. Such a difference could undermine the competitiveness of the French industry.

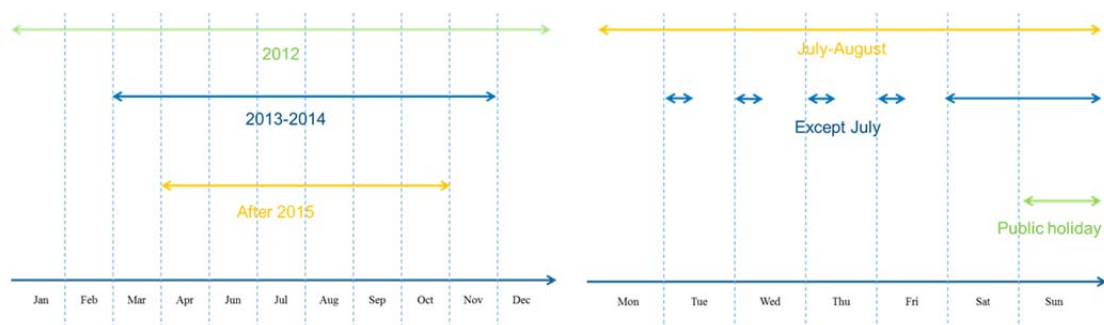
Appendix B

Detailed features of the mechanism

Definition of the products

- B.1 ARENH rights are calculated in a transparent and non-discriminatory way. The profile of the products is defined in a specific regulation and depends on the type of consumers:
- For large industrial consumers, these are flat products, meaning that they get a constant volume of ARENH for each hour of the year.
 - For other consumers, the products are calibrated to be representative of nuclear generation availability over the year. Indeed, consumption is much higher in winter than in summer. Therefore, EDF currently optimises maintenance and refuelling planning so as to adapt to French national consumption. This calibration allows volatile consumers to benefit from this optimisation.
- B.2 Alternative suppliers must be able to cover the customers' consumption up to the share of nuclear generation on French consumption. The Distribution of ARENH rights amongst suppliers depends on their customers' consumption during hours of low national consumption. These hours are presented in Figure 5.

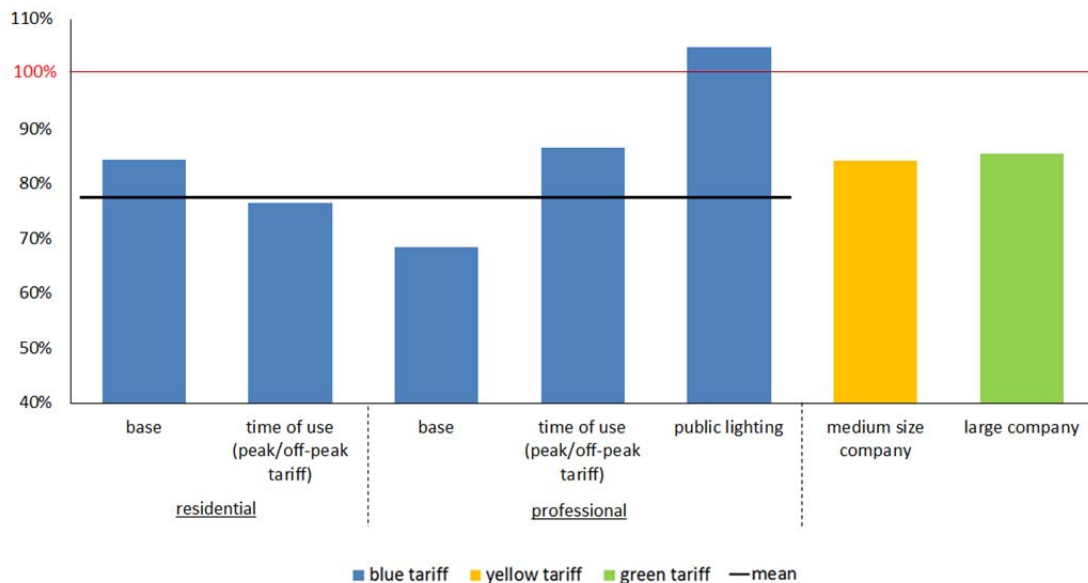
Figure 5: Repartition of hours during which ARENH rights are calculated



Source: CRE

- B.3 Another reason why ARENH products are attributed based on low national consumption hours is to incentivise consumers to consume electricity during the off-peak hours rather than in the peak hours, especially given a critically high peak demand in France. Therefore, the actual share of ARENH in the total consumption of a customer depends on its load pattern: the more it is flat (or even contra-cyclical) the more ARENH it gets, as it is shown in Figure 6, depending on the types of tariffs.

Figure 6: Proportion of ARENH rights per type of consumers



Source: CRE

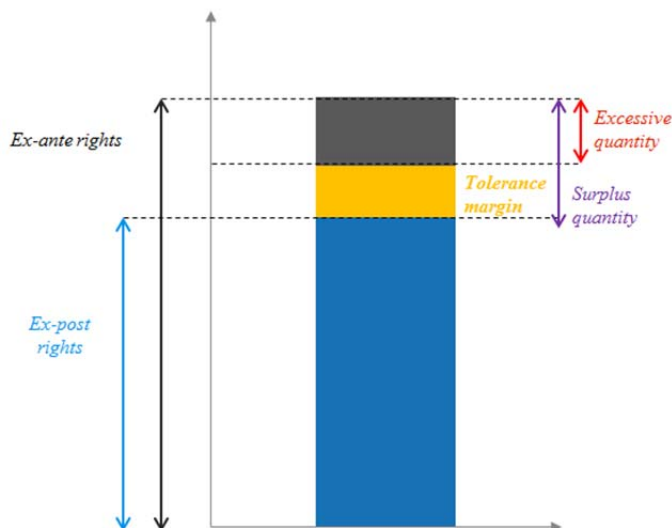
- B.4 In some cases, such as public lighting, the amount of ARENH may exceed the actual total consumption over the whole year, as these consumers consume more in off-peak hours than on average. As there is no destination clause for ARENH products, surpluses of ARENH for a given hour may be sold in the market and even exported. However, to be competitive in the retail market and maintain or increase their ARENH rights, suppliers have no incentives to sell in the market or export ARENH energy except occasional surpluses of rights for given hours.

Specification and control of the quantities

- B.5 In practice, retailers request ARENH volume in June of year Y for the period July Y – June Y+1, based on their forecast. In order to avoid windfall effects due to excessive requests, the ARENH includes a retroactive adjustment mechanism in case ARENH requested volumes turn out to be higher than allowed volumes based on actual consumption during low national consumption hours.
- B.6 This mechanism takes the form of a compensation paid to EDF for volumes requested in excess (“surplus quantity”). As long as the surplus quantity is small (within the tolerance margin of 10% of the allowed volume), this payment is equal to the difference between the ARENH and the spot market price (plus an interest rate). Therefore, it is equivalent to a purchase of the surplus quantity by the alternative supplier in the spot market and thus does not involve a penalty.
- B.7 However, if the surplus quantity exceeds the tolerance margin of 10%, the quantity requested above this margin (“excessive quantity”) is subject to additional penalties. For each MWh of the excessive quantity, the alternative supplier pays the compensation twice.

Figure 7 below schematises the ex-ante and ex-post volumes of an ARENH user, “excessive quantity” in red is paid at the market price plus the penalties⁵⁴.

Figure 7: ARENH allocation and ex-post control



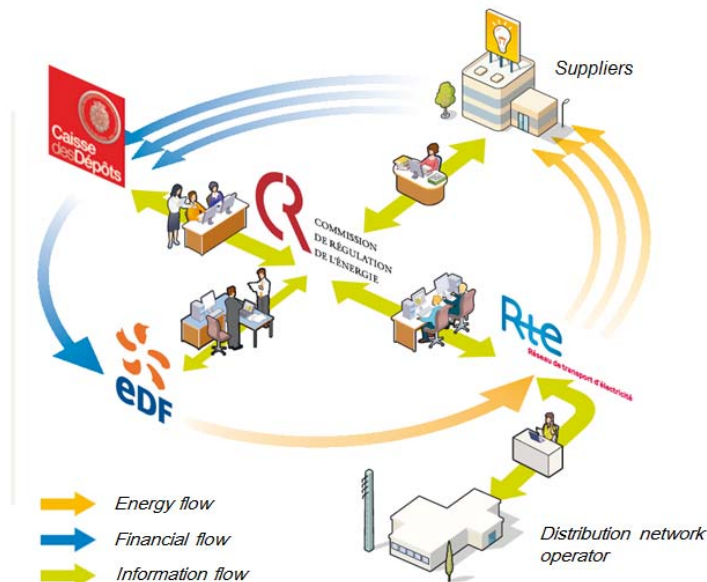
Source: CRE

Financial flows and guarantees

- B.8 The CDC acts as a central counterparty in order to secure financial flows between parties – to charge alternative suppliers on one side and pay EDF on the other side, limiting counterparty risk – and protect EDF and its competitors at the same time, by not having to directly negotiate bilateral contracts and by limiting access to individual information. Figure 8 below illustrates how the ARENH process works for alternative suppliers to request ARENH and to pay for its delivery.

⁵⁴ Further details are provided in the regulator's website:
<http://www.cre.fr/content/download/8206/73563/version/1/file/111215ArenhConsommationconstatee.pdf>

Figure 8: Illustration of the ARENH request and payment process



Source: CRE

- B.9 Resort to ARENH is not financially neutral since ARENH access requires bank guarantees defined by the CRE in accordance with CDC. These are annual guarantees and fixed at 1.5 times the average monthly volume of electricity valued at the ARENH price. Furthermore, in case of default, an annual interest three times higher than legal interest rate plus 3%, from the date following the due date to the settlement date, will be applied to the debt of the retailer⁵⁵.
- B.10 In addition, resort to ARENH can lead to capital requirements since EDF has to be paid by the end of the month whereas final consumers' payments generally occur 90 days after the delivery. This delay on in- and out- cash flows can be costly for alternative retailers.

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<http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000023926333&dateTexte=&categorieLie n=id>