

## Regulatory Challenges for Nuclear Energy in Liberalized Electricity Markets

A. Georgiev

*Faculty of Economics and Business Administration, St. Kliment Ohridski University of Sofia, 125 Tsarigradsko shosse Blvd., Block 3, 1113 Sofia, Bulgaria*

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**Abstract.** During the liberalization of the national electricity markets in the European Union, the nuclear energy sector faces new challenges. The rise of renewable energy sources and their participation in the wholesale markets through power exchanges and bilateral contracts lead to lower prices and intermittency of the system loads. Liberalized markets tend to discriminate capital-intensive generation technologies such as nuclear energy and some of the renewables. This report explores the current challenges and outlines some new regulatory mechanisms for ensuring the availability of nuclear power through “contracts for differences” for new nuclear units as well as for existing nuclear power plants.

**Keywords:** regulation nuclear energy, liberalization, markets

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### 1 Introduction – Liberalization and Nuclear Energy

According to the OECD report “Nuclear New Build: Insights into Financing and Project Management” [1], “in recent years, financing has proven to be one of the most important hurdles for nuclear new build”. The report says, that this is a specific concern in countries where renewable energy is on the rise and where liberalization of electricity market is implemented. The reason for this is in the high fixed and sunk costs, related to new nuclear build in combination with the need to mobilize large amounts of capital long before the first revenues of the project company.

The OECD has analyzed in depth this issue in another publication, “The Financing of Nuclear Power Plants” [2], where a list of issues, related to financing, is generated. Among them, there are several concerns related to markets and liberalization. For example, this report stipulates that governments should ensure that “electricity market regulation does not disadvantage NPPs”. One such opportunity for incentivizing nuclear energy is to allow nuclear projects to generate carbon credits. The latter may equalize the importance of nuclear and renewables in diminishing carbon emissions in a post-Kyoto protocol world.

In Bulgaria, the unbundling of the incumbent National Electric Company (NEK EAD) began in 2000, when all the 7 regional distribution companies, as well as the largest generating capacities (NPP Kozloduy, TPP Maritsa East 2, TPP Ruse, etc.) were taken out of the capital of NEK and established as separate 100% state-owned companies. The main purpose of the unbundling was to make more transparent the costs in the power sectors as well as to encourage competition between power producers. The next level of deregulation was the opportunity for direct competition between nuclear power producers on the Balkans – NPP Kozloduy in Bulgaria and NPP Cernavoda in Romania, for the baseload market in the region. However, such competition may prove impossible, due to the lowering wholesale

prices in the region, which are heavily affected by the increasing quantities of renewable energy, sold on the spot markets in Western and Central Europe.

Moreover, new nuclear build may be impossible due to the price uncertainty and the long payback period of such projects. Hungary (Paks), the Czech Republic (Temelin), Romania (Cernavoda), and Bulgaria (Belene) have already witnessed the difficulties to start new nuclear projects within a deregulated wholesale market with strong support schemes for renewables.

These challenges are valid not only for Bulgaria. It is extremely difficult to combine the policy objectives for a fully liberalized electricity market in Europe, defined with Directive 2009/72/EC and the whole Third Energy Package, with the objectives for the support of specific energy resources through the obligations in Renewable Energy Directive 2009/28/EC. While the Third Energy Package requires equal treatment of all electricity producers, the RES Directive and the support mechanisms based on it give advantages to renewable energy. Even though the Energy and Climate Package, adopted in 2009, supports all low-carbon options, including nuclear, later developments show that renewable energy got most of the policy support in many member-states. In addition to this, the price of carbon did not reach the levels, predicted before the economic crisis of 2008, eventually leading to increased availability and production by coal-fired thermal power plants. This effect has been intensified by the export of cheap coal from the United States as a result of the shale gas boom there.

The European Commission has published several communications in the last 2 years, suggesting that RES support should be changed for new projects in order to reflect the new market situation [3]. However, the current contracts should not be changed one-sidedly and retroactively, but with the support of the RES sector itself.

## 2 Possible Solutions for Increasing Project Stability

One of the conclusions of the OECD report from 2015 [1] is that the liberalized electricity markets which set prices according to the variable costs of marginal technology, generate “a bias against capital-intensive technologies”. According to the report, the lack of compensations (carbon taxes, etc.) would favor carbon-intensive fossil-fuel technologies such as gas and coal, while low-carbon generation (such as nuclear, hydro or renewables) will be disadvantaged in liberalized electricity markets. The reason for this is that the investors in capital-intensive technologies are exposed to greater financial risks than the ones who invest in less capital-intensive technologies. Another general conclusion of the OECD report, related to liberalization and prices, is that “investors will not choose the technology with the lowest possible average lifetime costs but the technology that minimizes their overall investment risk”, which makes the idea that “competitive markets create a level playing field for all technologies” invalid. However, there may be a solution, which combines some risk with the support for new large generating plants: support schemes that target the fixed cost proportion of new nuclear projects rather than their lifetime costs as in the case of CfDs, the report also says.

In order to secure the future revenues of a large power plant, especially for new nuclear build, governments may choose one of several options. They could preserve regulated prices – this is an approach, used in some developing economies as well as in some of the states in the USA, where deregulation never started or was stopped before its completion. This is not an option for the European Union, where all regulated prices had to be abolished in order to promote the Internal Energy Market and the full liberalization of the wholesale electricity trading. So the only option left is to liberalize the electricity market, but to leave some support mechanism in place in order to promote low-carbon and baseload generation.

There are several options for a support scheme, which would ensure the promotion of baseload electricity production:

- Feed-in Tariff – a fixed price for future quantities (e.g. Germany)
- Fixed Premium Feed-in Tariff – a fixed premium on the average market price (e.g. Spain)
- One-Way Contracts for Difference – the market price add-on is not returned (e.g. the Netherlands, Denmark)
- Two-Way Contracts for Difference – the market price add-on is returned to the buyer (e.g. United Kingdom)

## 3 Contracts for Difference – a Viable Solution?

There are several countries in the European Union, which have already introduced capacity remuneration mechanisms (CRMs) for ensuring the operation of current and future power plants. The United Kingdom has implemented

centralized capacity auctions; France introduced decentralized forward capacity obligation; Germany has a partial re-dispatch and winter reserve mechanism and considers to apply it market-wide; and other EU-members may soon follow up on their lead [4].

In the United Kingdom, the “contracts for difference” (CfD) model was proposed initially for the investment in 2 new nuclear plants by the French EDF. The two plants – “Hinkley Point C” and “Sizewell C” have a total of 4 reactors. According to the contracts, there will be a “strike price” and the generator will sell the power as normal, but will receive a variable top-up to the “strike price”. If the market reference price goes above the strike price, the generators must pay back the difference. The duration of the payments under the CfD for “Hinkley Point C” would be for 35 years. The CfD also will have at least two operational cost review arrangements – at year 15 and year 25, in order to reassess operating costs and adjust the strike price if necessary. Also, if the developer achieves savings during the construction or through refinancing or equity sales, the strike price would be reduced. The power plant at “Hinkley Point C” is expected to be commissioned in the early 2020s.

In October 2014, the European Commission has given its approval for the state aid, which the United Kingdom government wants to provide for the “Hinkley Point C” Nuclear Power Station [5]. The support mechanism is using CfD. The decision notes, that “many of the terms agreed reflect those of the CfD for other technologies, and in particular renewable energy technologies”. In July 2014, the European Commission has approved another state aid mechanism for the UK – CfD for renewable energy.

According to the decision, the strike price for “Hinkley Point C” NPP will be set at GBP 92.50 per MWh in 2012 nominal prices, while if an investment decision to build the new “Sizewell C” NPP is taken, using the same design and allowing for the opportunity to share some costs for the HPC reactors, the strike price will be changed to GBP 89.50 per MWh, again in 2012 nominal terms. The strike price will be indexed with the Consumer Price Index.

Furthermore, the CfD also gives a guarantee to the investor (EDF from France) if a political decision is taken to shut down the new nuclear power plants. According to the CfD, the investors will be entitled to compensation if the UK government decides to shut down “Hinkley Point C” NPP “on political grounds (and not on health, safety, security, environmental, transport or safeguards concerns)”.

Meanwhile, in 2015, Austria has filed a complaint at the European Court of Justice against the CfD state aid scheme, approved by the European Commission. Austria claims, that under EU regulations, “Hinkley Point C” NPP should not receive state aid because nuclear power does not constitute a new form of energy and nuclear generation is viable without government support. According to a statement by the UK Department of Energy and Climate Change’s spokesperson, Austria could not submit a challenge “of any merit”. However, it is the previous team of the European Commission, headed by Jose Manuel Borroso, that voted the positive decision for the CfD scheme.

It is still not known how the new European Commission, headed by Jean-Claude Juncker, will defend it in the European Court of Justice. The Vice-President of the European Commission, the Slovak Maros Sefcovic, however stated, that he supported the state aid scheme, because he found it compatible with the state aid rules and because it followed an identified market failure [6].

#### 4 The 4th Energy Package

However, supporting nuclear through such mechanisms may not be easy anymore. As the Executive Director of ACER Mr. Alberto Pototsching suggests, "...in an integrated European energy market, security of supply (and other related issues) are no longer exclusively a national consideration, but should be addressed as a regional and pan-European issue". What he means is that generation and resource adequacy should be addressed and coordinated at regional and European level in order to increase the positive effects of the Internal Energy Market and to avoid distortions in the market [7]. This will be one of the main challenges for the European electricity market in the coming years.

On July 15, 2015, the European Commission announced its "Summer Energy Package", which paves the way for a new legislative change, which could be eventually turned into a "4-th Energy Package". According to the official press-release [8], the Commission has started a Public Consultation on the new electricity market design. One of the aims of the reform is to "facilitate investments, notably in renewables and low carbon generation". Even though nuclear is not mentioned per se, the widening of the support schemes from renewables only to renewables plus low-carbon (including nuclear) could be expected. The fact-sheet, provided by the European Commission together with the press-release, states, that one of the prerequisites for a flexible electricity market is to ensure, that the markets provide "the right signals for investments in generation and the efficient use of available resources".

The Commission also wants to "reap maximum benefits from cross-border competition and allow decentralized electricity generation" and to help consumers "to generate and consume their own energy under fair conditions in order to save money, help the environment, and ensure security of supply". The latter is a policy objective toward smaller generating capacities, which should be taken into consideration by all investors in large baseload generation, including nuclear.

#### 5 What Should Bulgaria Do?

Unfortunately, the EU-level energy policy imbalances have been aggravated in Bulgaria. It is extremely difficult to combine the policy objectives for a fully liberalized electricity market in Europe, defined with Directive 2009/72/EC and the whole Third Energy Package, with the objectives for the support of specific energy resources through the obligations in Renewable Energy Directive 2009/28/EC. However, the RES directive itself offers a viable solution – to support green energy through

administratively-set feed-in tariffs, or through market-based tradable green certificates. Bulgaria, for example, chose the feed-in tariffs model, which aggravated the delay in the local market liberalization, while neighboring Romania is successfully implementing the green certificates model. Another difference between the two neighboring markets is the presence of an experienced power exchange operator in Romania – OPCOM, while Bulgaria still struggles to found its own energy exchange.

The liberalization of the power market becomes even more complex, when all the current long-term contracts are taken into consideration. As part of the modernization of the national energy system, the Bulgarian public supplier and incumbent company NEK has concluded two 15-year contracts with large TPPs generating electricity from local lignite coal. One of the power-purchase agreements (PPAs) was concluded with the American company Entergy (later on replaced by the Italian Enel and then by the current US-based ContourGlobal) for the rehabilitation of the TPP Maritsa East 3 (908 MW). The second contract is with AES for the construction of a new TPP with a capacity of 670 MW. In addition to this, some of the capacities in the state-owned TPP Maritsa East 2 are also tied with a PPA to NEK. And last, but not least, there are long-term contracts with renewable energy producers for duration of 12 to 25 years for a total capacity of about 2000 MW, most of them photovoltaics. Also, NEK and the end suppliers (CEZ Electro Bulgaria, EVN Bulgaria Electricity Supply and Energo-Pro Sales) should purchase with priority the efficiently produced electricity from cogeneration plants at industrial sites and district heating plants, which have a combined capacity of over 1300 MW.

The maximum winter consumption of Bulgaria in the coldest days of January is about 7500 MWh per hour and the lowest consumption, usually in April, is about 2500 MWh per hour. With a total installed capacity of 14000 MW and priority purchasing of the electricity from capacities of over 5000 MW, the local market could not be liberalized efficiently. The challenge is aggravated by the strict contract conditions and the legislative requirements to purchase this electricity production and to include it in the mix of the regulated market. Thus, when consumers choose a new supplier of electricity, the first effect is that there is not enough capacity to offer them real alternatives and the second one is that the "expensive" energy, generated through PPAs and feed-in tariffs should be distributed to a lower number of buyers. In order to solve this multiple-layer equation, the government, the regulatory commission, the generators, and the suppliers at both segments of the market should coordinate swift transition of all current contracts in order to let the national market meet its EU-obligations.

One of the best options could prove to be a large CfD scheme, which should include:

- renewable energy producers, who currently operate under the FiT model;
- the two large TPP's PPAs, for the remaining time of the two contracts (until 2024 and 2027);

- any new low-carbon generation, which needs support in order to diminish the risk of high capital investments: e.g. new renewable energy technologies, clean coal, and nuclear.

However, new investment projects should only be considered under a transparent and integrated market environment. The Bulgarian market alone does not need new generating capacities for its internal consumption of electricity – it is already oversupplied. New generating capacities would be viable only into a regional perspective – as competitors to other new generating plants in the neighboring countries. In order to create such investment environment, there are several prerequisites needed:

- a transparent legal and regulatory environment in terms of market liberalization;
- implicit allocations of cross-border capacities through market coupling;
- limited role of the state as investor – leaving new projects primarily to private investors.

## 6 Conclusion

New nuclear build is losing pace in the European Union as a result of the high price risk, related to market liberalization. In the same time, we have seen that liberalization of the market is not “technology neutral”, as it gives advantages to low-risk low-capital technologies. It is up to the state’s energy policy and strategy to define whether a country would rely mainly on distributed small and intermittent capacities or to create an investment environment for large baseload generating capacities such as nuclear. If such decisions are present, there are currently options, which are compatible, according to the European Commission, to the internal market. Currently, the best of those

are the contracts for difference (CfD), which are going to be implemented in the United Kingdom. Such a model could also be used in order to accommodate the existing renewable energy capacities under a better designed market environment.

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