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author: Balázs Romhányi

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Author:
Balázs Romhányi

Editor:
András Perger (Energiaklub)

Professional consultant:
Antónia Hüttl

The study and its background calculations are also available on the websites of Energiaklub Climate Policy Institute and Applied Comunications and Fiscal Responsibility Institute Budapest:
www.energiaklub.hu
www.kfib.hu

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www.pakskontroll.hu

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EXECUTIVE SUMMARY

The costs and benefits to be expected from the Paks 2 nuclear power plant project can be analysed in a number of dimensions. Of these, this paper limits itself to aspects of fiscal policy.

Even though experience shows that in the case of projects of this magnitude political considerations come into play, the effective EU rules governing statistical recognition, which determine the effect of the project on the Maastricht balance and public debt, are clear enough that the project should be classified in the government sector.

The statistical accounting system of the EU and its debt reduction rule highlight the fact that the financial burden of the Paks project cannot be passed on to future generations. Instead, it should be borne by those who pay taxes or receive public funds at the time of the implementation of the project. If the debt ratio is to be reduced from its current level of 80 per cent to around 70 per cent by 2024, the Paks project, corresponding to 10 per cent of GDP, makes this as hard to achieve as if the debt ratio needed to be reduced to 60 per cent in the same time-frame. This problem remains even if the government can borrow from Russia instead of issuing government securities – no matter how favourable the terms. The debt reduction objective could be achieved only through privatisation or a substantially better fiscal balance.

The future trend of the average price on the EU market, currently 35-36 EUR/MWh, is highly uncertain; however, both downside and upside risks are present. Currently, the market price in Hungary is substantially higher as the cross-border trade of electricity is still hampered by technical constraints. If these constraints persist, mostly due to political decisions, the free market price in Hungary may be higher, but the new power plant will displace other generation facilities, which will substantially lower the value added by the project on the macroeconomic level relative to the baseline. In our calculations we assumed that the Hungarian electricity market will be integrated with the European market.

If, from the aspect of the investor, we only take into account property income, the threshold price allowing for a ROI of 4 per cent would be around 80 EUR/MWh, very close to the estimate of the Regional Centre for Energy Policy Research.

If we take into account property income plus all the additional tax revenue, the entire project may break even at 40-45 EUR/MWh from a narrow fiscal perspective, but this is far from saying that it would also have a positive return for the economy as a whole.

If we look at the whole economy, we need to reckon with two more effects. One is the part of the GDP surplus generated through the project that is not centralised by the Government. The other one is the output loss that results because in order to comply with the Hungarian and EU debt reduction rules, a headroom of approximately HUF 3000 billion needs to be created in the budget in the investment stage of the project through appropriate adjustment measures. This means that at the start of the project a package of measures improving the balance by some HUF 450 billion needs to be implemented, and it must be kept in place practically throughout the life of the project. Accordingly, this issue cannot be resolved with a one-off measure implemented in 2018. The size of the output loss depends primarily on the nature of the sustained adjustment measures. If the Government opts for the increase of consumption taxes or the reduction of cash transfers, a modest return on investment of 4

per cent can be assured for the project on the level of the entire economy even at an electricity price of 50-60 EUR/MWh. If, however, the project displaces government consumption or transfers to private investment, the electricity rate required for the project to yield a positive social return may rise much higher, to 80 EUR/MWh or even to the totally unrealistic level of 200 EUR/MWh.

These outcomes are definitely optimistic because, on the one hand, we reckoned with no time or budget overruns when calculating investment costs, and on the other hand, the 4 per cent real interest rate is only the average real yield of risk-free government securities in the long run, containing no risk premium, whereas the expected return is significantly higher for private investments, which compete with the state for the savings of households. A legitimate question that is not discussed in this paper: even if the Government manages to free up HUF 450 billion net in the budget annually in the forthcoming decade, is this fund put into the best use for society by being invested in the construction of a new nuclear power plant?

The Government would meet the constitutional requirement of sustainable and transparent fiscal policy if it were to publish its own assumptions and calculations as well as the concrete plans for the required fiscal adjustments. The Government will have to come forth with its plans in the convergence programme of the spring of 2015 – looking forward to 2018 – at the latest, unless it proposes to postpone the project. The longer the uncertainty, the greater the output loss due to the required fiscal measures, as was indicated by the events in the 2011-2014 period.

CONTENTS

1 PURPOSE OF THE ANALYSIS

In our analysis we seek to answer five questions:

1. What electricity price needs to be assumed for the forthcoming 70 years to make the project break even for the state (as both investor and tax collector), or to assure that at the time of the decommissioning of the new power plant the debt ratio is the same as it would have been in the absence of the project?
2. Through what channels and to what extent can the project contribute to the real GDP of Hungary?
3. At an electricity price level assuring average long-term return for the state, when and to what extent does the project limit the margin of discretion of fiscal policy?
4. What level of output loss results from the various measures that can offset the narrowing of the fiscal latitude, and at what price can such measures assure a sufficient rate of return at the level of the entire economy?
5. In the present situation, how could the Government meet the constitutional requirement of transparent and sustainable fiscal policy?

Issues that we do not address include energy security, environment and foreign policy; furthermore, we will not consider whether, if the Government is really able to create a fiscal margin of discretion in the medium term in the order of hundreds of billions of forints, is this sum used in the best interest of society by being invested in the construction of a new nuclear power plant.

2 WHAT IS KNOW ABOUT THE PROJECT AND ITS FUNDING AT THIS POINT

1. The project will be implemented by MVM Paks II Atomerőmű Fejlesztő Zrt. (hereinafter: NPP), a directly state owned company established in 2012 that is currently outside the government sector in statistical terms. The power plant as a tangible asset will not be taken into direct state ownership.
2. The capacity of the power plant will be increased by the addition of two VVER-1200 (V491) type reactors, with gross rated power of 1170 MW each, supplied mostly by Russian vendors; in addition, in an independent project, the planned working life of the four existing blocks will also be extended to 2034–2036. The second reactor will be completed two years after the first one.
3. According to experts[1], the physical implementation of the project may start in 2017 at the earliest, and the first block may be completed by 2024, the second by 2026 (assuming no delays in the project).
4. The intergovernmental loan to finance 80 per cent of the project will be granted to the Hungarian State by the Russian State. The terms of the loan:
    a. The facility is EUR 10 billion
    b. The loan can be used exclusively to cover the costs of the project

[1] CEO of MVM Paks II Zrt. Sándor Nagy said on 9 June 2014 that "the permission to start the expansion project at Paks may be granted by end-2017" (http://archiv1988tol.mti.hu/Pages/HirSearch.aspx?Pmd=1)

c. At the official acceptance of the various stages of the project, the loan is deemed to have been disbursed at a ratio corresponding to the value of the works accepted

d. Repayment must be started when the power plant is commissioned, but not later than 2026

e. The repayment period is 21 years, within this, 25 percent of the total amount of the original borrowing is repayable in the first 7 years, 35 per cent in the second 7 years and 40 per cent in the third 7-year period, with the payments distributed evenly.

f. The interest rate is 3.95% until the earliest of the commissioning of the project or 2026, then it will change to 4.5%, 4.8% and 4.95% in 7-year cycles.

g. An availability fee is payable on any undisbursed amounts at the rate of 0.25 per cent.[2]

Simultaneously with the implementation of the project, as a stage is officially accepted by the investor, 80 per cent of the cost is paid to the suppliers by the Russian government, and 20 per cent by the Hungarian party.

3 REVENUES AND EXPENDITURES DIRECTLY RELATING TO THE PROJECT

The only substantive revenue from the project is the net sales revenue from the sale of electricity. Costs can be classified into four main categories:

1. Investment costs
2. Cost of funding the investment
3. Procurement of fuel and waste treatment
4. Operation and maintenance
5. Decommissioning

[2] The availability fee is regulated in Article 2 (5) of the Hungarian-Russian intergovernmental loan agreement. Its interpretation is not entirely clear from the Hungarian text

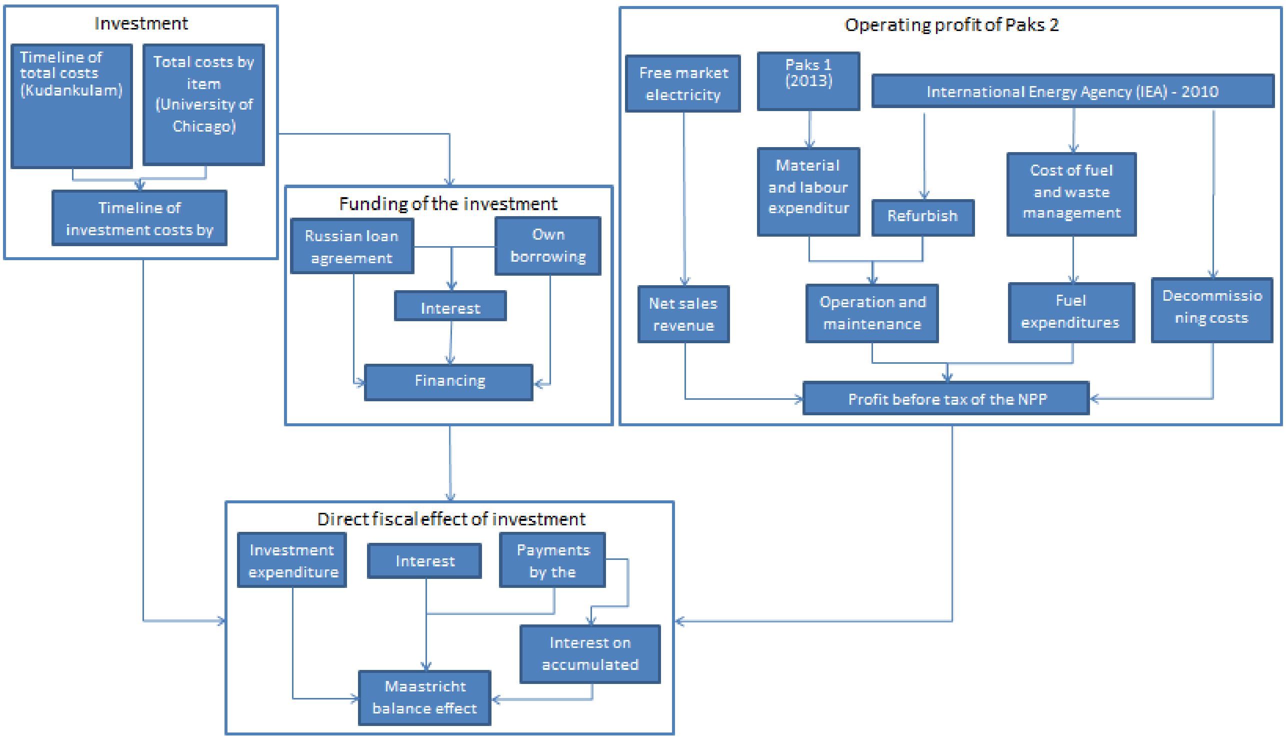

Figure 1: Key factors affecting the financial profitability of the NPP

The sources and correlation of our estimates for the main items affecting profits are illustrated in the table (Fig 1).

In keeping with the separation of the funding and profitability of the Paks 2 power plant, we prepared our estimates in separate blocks as well. The first block of calculations relates to project implementation, which is supplemented by the block on the disbursement and repayment of loans. The block on the financial profitability of the operating power plant relies on the underlying assumption of calculations for the service time and electricity production of the plant, thus in the figure we have explicitly included only calculations directly linked to financial results.

We assume that the NPP will always be able to sell the electricity generated at the world (or rather European) market price, therefore the revenues of the NPP are independent from Hungarian growth prospects. Consequently, the return on the investment depends on real economic developments in Hungary through only two channels. One channel is the labour cost of the NPP. As we assumed that the average salary of NPP employees will keep pace with the productivity of the Hungarian economy as a whole, the faster labour productivity, and thus the real wage in the market, increases in Hungary, the less (!) profitable the NPP and the worse the return on investment gets. We assume that in the forthcoming decades productivity will increase by around 2 per cent a year on average.

The other channel through which the real economic outlook affects the return of the project is the real interest rate. According to the Commission's Impact Assessment Guidelines (EU, 2009), a 4% discount rate is recommended for use in assessing state projects, as this has been the average real yield required from long-term government securities in the past 30 years.

We should note that the yields customary in the private sector should also be demanded from public projects as the state competes with the private sector for scare capital resources. If the state imposes taxes on citizens to then sink the funds in low-return projects, society would be better off if the public projects were not implemented, the taxes not collected and citizens could lend their money to investors who would use them in higher-yield projects. Nevertheless, we have adopted the 4 per cent real yield assumption and used it in our calculations below.[3]We used the data of the International Energy Agency to model the financial statements of the NPP.[4]

3.1 Investment costs

As to the total cost of the investment, all we know from official sources is that the Hungarian State will take out credit of EUR 10 billion from the Russian State to cover 80 per cent of the total cost. Accordingly, the total cost is estimated to be EUR 12.5 billion.

In case of investment projects, both the timing and composition of investment expenditures must be examined. The time-line of expenditures determines the scheduling of the disbursements of the credit. The figure below illustrates the distribution over time of the investment costs of two power plants using different technologies.

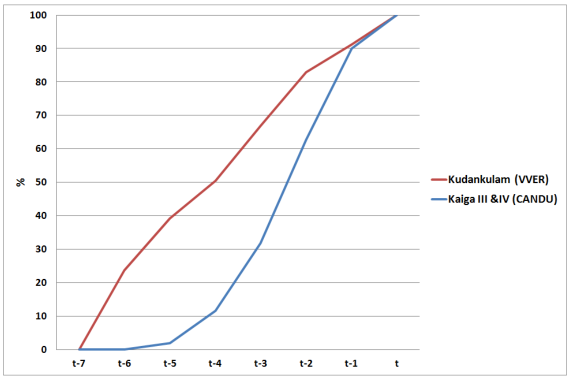

Figure 2: Distribution over time of the investment costs of two nuclear power plants in India

For the time-line of the Hungarian project, we used the first 7 years of the construction of the Kudankulam power plant in India as an empirical example. Work on the power plant started in 2001 and, following a number of delays, are expected to be completed this year and next year in the various units. As the overwhelming majority of the project costs arose in the first half of the period, we took into account the costs incurred at that time.

The composition of expenditures will be relevant for the estimation of the domestic value added, as the share of the domestic contribution may be different in the various phases. For instance, domestic businesses may play a significantly greater role in the construction phase than in the installation of the reactor vessel, as the latter is essentially a purchase of equipment and its installation also requires special high-level qualifications and experience. We took the assumptions for the composition of the investment from the study of the University of Chicago, which discloses in a tabular form the cost of the various major works (such as the construction of structures, construction of the reactor plant, construction of the turbine plant, electric plant equipment, engineering and supervision services) as a percentage of the total project cost. We compiled the cross-table

[3]More precisely, we shifted the present yield curve of Hungarian government securities so that the average real yield is exactly 4 per cent throughout the time horizon of the project.
[4] IEA, 2010; p. 59.

for the time-line and the breakdown of the investment based on these two boundary conditions. First prepared a cost estimate for the reactor 1 investment.

1. reactor	Ref.	2018	2019	2020	2021	2022	2023	2024
Structures & improvements								
Factory equipment cost	1,9	1,9						
Site Labor Cost	9,1	4,5	4,5					
Site Material Cost	5,3	2,7	2,7					
Reactor plant equipment								
Factory equipment cost	20,0				16,0	4,0		
Site Labor Cost	2,9					1,5	1,5	
Site Material Cost	1,1					0,5	0,5	
Turbine plant equipment								
Factory equipment cost	14,7					9,8	4,9	
Site Labor Cost	2,0						1,0	1,0
Site Material Cost	0,6						0,3	0,3
Electric plant equipment								
Factory equipment cost	2,9							2,9
Site Labor Cost	1,5							1,5
Site Material Cost	0,7							0,7
Misc. Plant equipment								
Factory equipment cost	1,8	0,6	0,6	0,6				
Site Labor Cost	1,5		0,8	0,8				
Site Material Cost	0,5		0,2	0,2				
Main cond. Heat. Rej.								
Factory equipment cost	2,6		1,3					1,3
Site Labor Cost	1,2		0,6					0,6
Site Material Cost	0,2		0,1					0,1
Construction services								
Factory equipment cost	4,1	4,1						
Site Labor Cost	5,9	2,0	2,0	2,0				
Site Material Cost	5,3	5,3						
Engeneering & home office service								
Factory equipment cost	7,5	2,5	2,5	2,5				
Site Labor Cost	0,0	0,0						
Site Material Cost	0,0	0,0						
Field supervision & field office services								
Factory equipment cost	5,1			5,1				
Site Labor Cost	0,7	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Site Material Cost	0,7		0,1	0,1	0,1	0,1	0,1	0,1
Total								
Factory equipment cost	60,7	9,1	4,4	8,2	16,0	13,8	4,9	4,2
Site Labor Cost	24,9	6,6	8,0	2,8	0,1	1,6	2,6	3,2
Site Material Cost	14,4	8,0	3,1	0,4	0,1	0,6	0,9	1,2
Overall	100,0	23,7	15,5	11,4	16,3	16,1	8,4	8,7

Table 1: Expected breakdown of the construction costs of reactor 1 by project element and year

The construction of reactor 2 starts with a delay of two years relative to the first reactor (except for the design and the costs of site preparation). We reckon with no economies of scale for the second block. Accordingly, we obtain the following time-line for the total investment cost:

Table 2: Expected annual breakdown of the total investment cost of the two reactors (per cent of the total project cost)

2018	2019	2020	2021	2022	2023	2024	2025	2026	Together
17,6%	12,6%	13,0%	11,0%	12,5%	12,3%	12,4%	4,2%	4,4%	100,0%

Based on the available figures, the total cost of the project may be slightly above the international average. The international data contain no interest expenditure arising from the time requirement of the project ('overnight cost'), and they use the net investment cost at the real value calculated for the physical start of the project ('first pour of concrete'). The Hungarian-Russian credit facility contains no interest expenditure either, while investment expenditures clearly need to be financed at current prices. Therefore, to assure comparability, we converted project costs to the present value at 2018(!) ('overnight cost'). Thus we obtained EUR 8.8 billion.

Using international data, and reckoning with a project value of 3600-4000 EUR/MW (4800-5300 USD/MW), the total cost may be EUR 8-9 billion. This means that the officially communicated budget is closer to the top edge of the range but it contains no buffer for the risk of cost overruns, which occur in practically every investment project. We wish to note that we worked under the assumption that the total project budget of EUR 12.5 billion (overnight cost of EUR 8.8 billion) contains all investments required for the operation of the power plant in accordance with the official technical specifications, though this is not completely clear from the information available to us.

We also assigned Hungarian supplies to the various stages. We assume that 40% of all site labour and 20% of the site material (by cost) will be supplied by local contractors. Field supervision is an exception, where we assumed the two ratios to be 80 and 40%, respectively. 100% of the factory equipment (consisting mostly in reactor components and turbines) need to be imported. In the latter case it is an underlying assumption that, due to their special nature, the machinery and components necessary for the power plan can be procured only outside Hungary.

Table 3: Assumed share of Hungarian contractors in the project (per cent of the total project cost)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	Together
Together	3,3	3,1	1,6	0,8	1,0	0,7	1,2	0,6	0,8	13,3
Factory equipment costs	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Site labor costs	2,2	2,5	1,0	0,7	0,9	0,6	1,0	0,5	0,7	10,2
Site material costs	1,1	0,6	0,6	0,1	0,1	0,1	0,2	0,1	0,1	3,0

3.2 Cost of fuel and waste treatment

The Hungary-Russia investment agreement defines the technical parameters of the power plant in extremely broad terms. Consequently, in order to estimate the nuclear fuel requirement, we took the technical parameters of the VVER - 1200 reactor from the technical specification of the International Atomic Energy Agency, and the formulae applicable to fuel consumption and the unit cost of fuel from the auxiliary calculations of the article on the rate of return of the Jaitapur nuclear power plant in India[5].

[5] IEA Status Report, 2011; and Raju and Ramana, 2013

One parameter of the calculation of the fuel requirement is the annual operating time. The related assumption was estimated based on three sources of information

1. According to the factory brochure, the VVER-1200 reactors can achieve an availability of 90 per cent throughout their operational life.

2. According to the econometric estimate of a comparative study from 2003[6], the capacity utilisation of existing nuclear power stations depends on their age.[7]If we were to accept the parameters stated in the article, the average capacity utilisation of Paks 2 throughout its operational life would be 81.3 per cent.

3. A French study[8] found that the availability of French nuclear power plants has not been above 76 percent for years, instead of the 90 per cent considered by experts to be a realistic expectation. Even this is attributable mainly to excess supply, but excess supply may be an issue for Paks 2 as well, particularly at the beginning of the period (between 2025 and 2037), when the reactors in Paks 1 are also in operation.

Based on these three factors, we made the simplifying assumption that the availability of the Paks 2 NPP will be 85 per cent irrespective of time.[9]

We linked the cost of waste management to the volume of fuel used (with a delay of two years). If the power plant works with higher capacity utilisation and higher consumption, the cost of waste management is proportionately higher. We calculated the unit cost of waste management so that the sum of the cost of fuel and waste management ('fuel cycle cost') is identical with the value indicated in the publication of the International Energy Agency (8.77 USD/MWh).[10]

The unit cost of both the fuel and waste management were adjusted for inflation.

At present, waste management (including the related investment projects such as the landfill in Bátaapáti) is mostly performed by the Central Nuclear Fund, though in theory the expenditures are financed from payments made by the NPP. Accordingly, we assumed that the costs of waste management will be borne by the NPP.[11]

3.3 Operation and maintenance (O&M)

We estimated the costs of operation based on the income statement of Paks 1 for 2013.[12] Operational expenditures include labour costs and material costs, with the exception of fuel acquisition and waste management.

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[6] Maloney (2003) p. 4

[7]The capacity utilisation of Block 3 of Paks 1 has been continuously increasing since the 1990s, which contradicts the results of Maloney

[8] Boccard (2014) p. 7

[9]The same assumption is made by the Regional Centre for Energy Policy Research in its paper published in the spring of 2014

[10] IEA: Projected Costs of Generating Electricity, 2010, p. 59.

[11] Naturally, this has no effect on the rate or return of the project or on its fiscal impact, but it makes financial processes more transparent and shows the value added by the NPP correctly in economic terms. That is because the cost of waste management needs to be deducted from the value added, as the same amount will appear as value added at the company performing the actual waste management operation. If, however, the same amount were to be paid in the form of taxes, then – considering that taxes do not constitute intermediate consumption – they would not be deducted from the value added by the NPP.

[12]The annual report of the Bulgarian Kozloduy power plant shows similar results.

In 2013 Paksi Atomerőmű Zrt. employed some 2500 persons, while for Paks 2 we assume 1500 employees in view of the personnel required to operate modern nuclear reactors (750 persons per reactor).[13]

We assumed material expenditures to be proportionate with the rated capacity of the reactor, therefore we multiplied the unit cost of Paks 1 calculated by reactor capacity by the assumed rated capacity of the Paks 2 reactors.

In the case of other items shown among expenditures in the income statement, we relied on the corresponding lines of the year 2013 income statement of the existing Paks power plant.

Synergies from the parallel operation of the two power plants are not considered when calculating the operational costs of Paks 2. There may be some expenditure items where the availability of services in the Paks Nuclear Power Plant can be a benefit (e.g., management, accounting, marketing). These expense items may show some savings in the years of transition (that is, when the old and new plants operate simultaneously), but we do not expect these to be substantial relative to the total level of costs. Furthermore, the recognition of these costs in the accounts of Paks 2 is justified because all such costs will be borne by the new power plant after the end of the simultaneous operation.

Within operational costs, we adjusted labour costs for the nominal wage index of the macro path, and indexed other items for inflation. We halved operational expenditures in the first and last two years, when only one of the reactors is in operation.

We set the costs of maintenance so that the unit cost of operation and maintenance (O&M) per unit of output is identical with the average value specified for pressurised-water reactors in the publication of the International Energy Agency (16.87 USD/MWh at present value).[14] We assumed no major overhaul for the operational cycle, therefore we prorated maintenance costs to the actual electricity produced each year.

3.4 Decommissioning costs

According to the figures of the International Energy Agency, decommissioning costs for pressurised-water reactors are expected at around 2.6 USD/MWh.[15]As our calculations show that each reactor will generate some 485 TWh electricity throughout its life-cycle, the decommissioning cost will be HUF 288 billion at current prices for each reactor.[16] We determined the amount to be set aside for the decommissioning reserve based on the electricity actually generated in each year so that at the end of the operational life of the power plant it covers the HUF 576 billion cost of decommissioning, at 2014 prices, taking into account the interest accruing on the reserve. In our model the decommissioning reserve is accumulated by the state rather than by the NPP, that is, the NPP pays a quasi-tax to the state to cover decommissioning cost based on the volume of electricity sold. Naturally, the required level of the tax to cover decommissioning costs depends on real interest rate trends, as the reserve accumulates at a nominal interest rate (the sum of the inflation rate and the real interest rate) whereas we assume that the cost of decommissioning needs to be indexed only for inflation. The table below shows the required level of provisioning for decommissioning, at

[13] Nuclear Energy Institute, 2013 and Foratom, 2010

[14] IEA: Projected Costs of Generating Electricity, 2010, p. 59

[15] Idem

[16] Hungarian studies contain much higher values, even double that figure

2014 prices, as a function of the real interest rate.

Table 4: the required level of provisioning for decommissioning, at 2014 prices, as a function of the real interest rate

real interest rate (%)	Decomissioning costs (HUF/kWh)
0	0,588
1	0,427
2	0,302
3	0,208
4	0,140
5	0,091
6	0,059
7	0,037
8	0,023
9	0,014
10	0,009

If, for instance, the real interest rate is 4 per cent ('required real yield'), then HUF 0.14 must be set aside (at 2014 prices) for each kWh of electricity generated.

3.5 Revenues of the power plant

The primary revenues of the NPP obviously come from the sale of electricity. Assumptions on electricity prices are critical in the calculations as they make the project turn a profit or loss. We do not assume that the NPP would enter into long-term contracts.

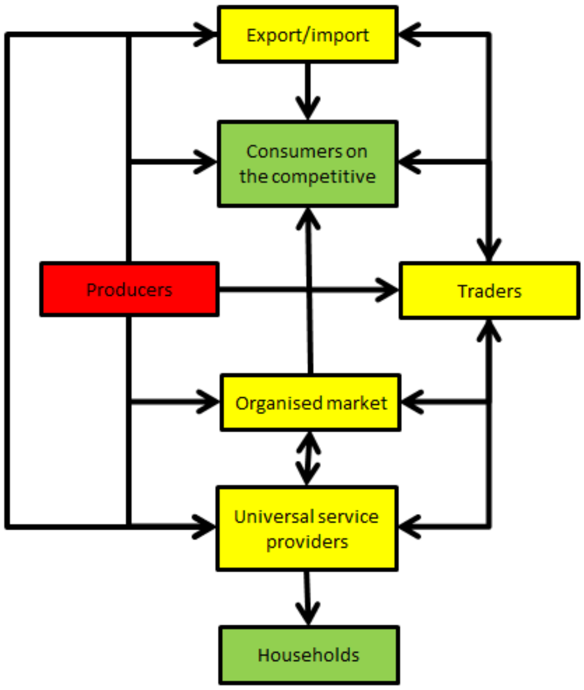
3.5.1 Volume of the electricity produced

The expected availability of each reactor was determined for the purposes of estimating the costs of fuel and waste management (Section 3.2). Assuming that the efficiency of the power plant remains unchanged irrespective of time and use, the total net electricity output can be determined from the net rated capacity and availability. Our calculations show that each reactor will produce 485 TWh of electricity during its whole life-cycle (60 years).

3.5.2 Market developments affecting the price of electricity

In the electricity market producers (power plants) are free to sell the electricity generated to traders or consumers. Almost all generators opted for the former arrangement, in 2013 selling almost 95% of the electricity to traders. Among traders, MVM Trade, a subsidiary of MVM, played a leading role as they bought 72.3% of the electricity sold by Hungarian power plants.[17]

Figure 3: Structure of the electricity market (directions of energy transmission)



Consumers can be divided into two categories: consumers served by universal service providers and those obtaining electricity in the open market. The maximum price that can be charged by universal service providers is set by the

[17] Data on market structure are taken from Chapter 2.1.1 of the 2013 report of MEKH (Hungarian Energy and Public Utility Regulatory Authority) to Parliament

relevant decree of the Ministry of National Development based on the purchase price applied by universal service providers. As universal service providers purchase 80% of the energy they supply from the MVM, the MVM's cost of electricity generation may be a major factor in households electricity tariffs. Universal service providers typically enter into 5–8-year agreements with the MVM. Consequently, by the time Paks 2 starts operating, they will be effectively free to choose their sources of supply. If universal service providers find cheaper sources either in the organised market or in the form of traders other than the MVM, it may be profitable for them to chose the lower-cost source because, even though the tariffs they charge to households will also be reduced due to the lower purchase price, they may still achieve a higher profit through increased sale volumes triggered by the lower price because of their flat margin.

Imports play a greater role in case of consumers purchasing electricity in the open market as, according to the MEKH, traders procure 56% of the electricity from imports and only 26% from the MVM.

At present the greatest obstacle to price reduction is the limited size of cross-border capacities: cheaper imports have volume constraints. To illustrate this fact: in the German EEX electricity exchange the price for next year is 35.5 EUR/MWh while the comparable price in the HUPX of Budapest is 44 EUR/MWh.

If technological constraints are eliminated in the forthcoming decade and an integrated network is established in Central Europe (including Germany), the wholesale price applied by the MVM may not persistently depart from the open-market price.

This strong influence of the open market is important when we want to establish the price at which the electricity generated by Paks 2 can be sold; in other words, to see whether the power plant can operate at a profit. If the free-market price remains persistently below the operating cost of Paks 2, the resulting loss must be borne by one of the actors (NPP, MVM, government). However, both the NPP and the MVM are state-owned, and the funds for the project are borrowed by the state itself, therefore **the entire risk is ultimately borne by the taxpayer.**

3.5.3 Expected trend in electricity prices

At present, the baseload quotations for 2015 in the German, Czech and Slovak markets are around 35-36 EUR/MWh.[18]

In the case of the Hanhikivi nuclear power plant in Finland, currently in the design phase, the price of 50 EUR/MWh is used for calculations[19], which also represents the cost price of the electricity generated by the plant as half of the owners of the plant are Finnish industrial companies that will be able to purchase the electricity produced there at cost.

According to another media report[20], the Ineos chemical group has an agreement with French nuclear power plants at the price of 45 EUR/MWh, under a contract of unknown duration.

In its analysis published in 2012[21] the International Energy Agency estimated that the wholesale price of electricity may increase by 30 per cent in Europe between 2011 and 2035, which

[18] Even though at present the Paks power plant sells electricity to the MVM at 45 EUR/MWh, this is not conclusive evidence as MVM is unable to purchase cheaper electricity from abroad due to narrow cross-border capacities.
[19] World Nuclear News, 2013 and World Nuclear Association, 2014
[20] BBC News, 2013
[21] World Energy Outlook, 2012, p. 207

at the time meant a projected price level of around 55-60 EUR/MWh.

In the National Energy Strategy published in 2012 the Hungarian Government made the assumption that electricity price will rise to 90 EUR/MWh by 2030.[22]

In that light, the guaranteed price for the British Hinkley Point C nuclear power plant is outstandingly high (according to some experts, the price is 'economically insane'), set at 92.5 GBP/MWh at 2012 prices (i.e., continuously indexed for inflation). Today this correspond to approximately 115 EUR/MWh. This was twice the price on the free market in the UK at the time; furthermore, because of indexation for inflation, this guaranteed price would almost certainly be above the market price throughout the 35-year fixed period.[23]

All three figures published in 2012 (IEA, Hungarian and UK) assumed a substantive increase in electricity prices; however, prices have fallen significantly since then.

The analysis of the European Commission in the spring of 2014[24] reckons with a 2.4 per cent annual increase up to 2020 relative to the current European average price of 30-50 EUR/MWh in the base case, but they expect a slight decrease thereafter, which, on our total horizon, corresponds to a mere 10 per cent rise over the current price level.

There are a number of risks around the development of prices on the open market. For one, the spread of renewable power plants and the advancement of their technology may lower the price of electricity in the free market. Another risk in the same direction is the increased energy efficiency of undertakings: European companies, having encountered high energy prices in recent decades, tended to cut their costs by improving energy efficiency, and declining demand may result in falling prices.[25]As a third factor, there are already substantial excess capacities in Europe (which is illustrated by the 76 per cent capacity utilisation of French nuclear power plants). This means that as soon as demand starts increasing, the supply side would be able to respond immediately – provided that the integration of networks is achieved.

A number of experts consider that in this situation the future increase or decrease of Hungarian electricity prices is a question of political decision.

3.5.4 Interest income of the power plant

If the after-tax profit of the NPP is lower than the net profit on a cash basis, the state as owner is unable to access all the financial assets of the company in the form of dividends. Even if the company paid the entire after-tax profits to the state as dividends, the owner can get to the part of the net cash profit in excess of that amount only in the form of an equity reduction. If, for some reason, the owner were not to reduce the equity in this manner, financial assets would accumulate in the NPP, which would earn interest income. Considering that in general the state has the objective of minimising (gross) public debt, we expect that the government will take the maximum possible dividend (or advances on dividends) each year as well as the maximum

[22]Ministry of National Development, 2012, p. 123, Table 2
[23]The Commission is investigating the case as their is reasonable suspicion that the price practically guaranteed by the UK government constitutes illegal state aid. URL: http://europa.eu/rapid/press-release_IP-13-1277_en.htm
[24] EU (2014a), p. 213
[25]This is also shown by the study of the European Commission looking at the relationship of competitiveness and energy prices (high energy efficiency in Europe is indicated by the figures on page 13 of the quoted paper (EU, 2014a))

amount of equity allowed by cash flow considerations (in the subsequent year). Accordingly, we reckoned with interest income only as a function of the annual cash-based profit.

3.6 Depreciation

Even though not an outlay, depreciation is a major item among expenses affecting the accounting profit or loss. This has no substantive effect on public revenues because, for the purposes of the budget, it does not matter whether the government obtains the profits of the NPP in the form of corporate profit tax or dividends. Nevertheless, the financial position of the MVM as a corporation needs to be monitored throughout the project because they need to comply with the provisions of the Company Act. This includes compliance with the rule stipulating that the owners' equity may not fall below two thirds of the registered capital. In theory, under the general accounting rules, buildings may be depreciated in 30-50 years, machinery and equipment in 15 years, software and IT equipment in 3 years, but longer depreciation periods are always allowed. The depreciation charge is calculated on the investment value; we assume that the company will write this off in 60 years, so that there is a 10 per cent residual value remaining at the end, which brings the annual depreciation charge to 1.5 per cent of the investment value. On top of the depreciation of the initial investment, there is the depreciation of refurbishment and investments made (and capitalised) during the year. For these, we use a uniform 10-year depreciation period.

4 FISCAL EFFECTS OF THE PROJECT

4.1 Funding of the investment

The State with draw down the Hungarian–Russian intergovernmental loan as the project progresses, and repays it under the rules set forth in Part 1 Section 4 of the loan agreement. In addition to the disbursement of the intergovernmental loan, the state will have to mobilise other resources

1. to fund the 20 per cent Hungarian portion of the investment value,
2. to repay the Russian loan,
3. to cover the interest payments on the own resources and the Russian loan.

We assume that the Government will always use borrowed funds to cover project-related expenditures, thus the total debt stock accumulated by the end of the period will show the total gross expenditure on the implementation of the project. In accordance with the recommendations of the EU, we assume that the Hungarian State will be able to raise the additional funds at a nominal interest rate of 7 per cent (4 per cent real interest rate and 3 per cent inflation). Thus under this arrangement we have not directly linked the profits generated by the Paks 2 power plant and the project-related borrowing (the payment of instalments and interest is not covered directly by the profits); instead, we made the calculations for the two sides separately.

Assuming that the State will draw down the entire EUR 10 billion facility and that the project is completed in 2026, the annual instalments and interest payments on the Russian intergovernmental loan are shown in the figure below:

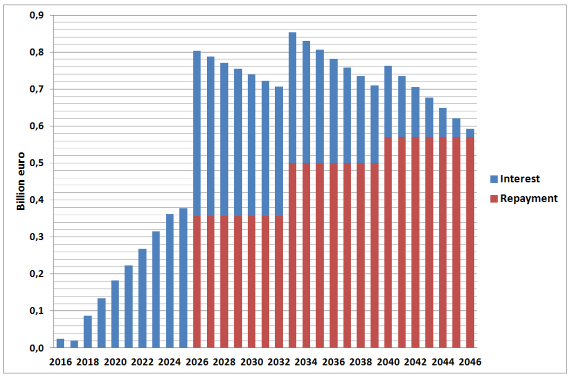
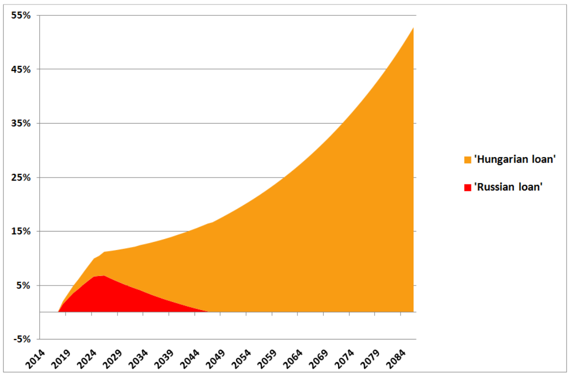


Figure 4: Repayment and interest payment on the Russian–Hungarian intergovernmental loan

As indicated above, the Hungarian party will have to borrow additional funds to cover the repayment of the Russian loan, the 20 per cent own resources and the interest payments on both. The figure below shows the growth of public debt due to the Paks project as a percent of GDP (assuming a 5 per cent nominal GDP growth).[26]



1. Figure 5: Stock of borrowing relating to the investment as a percentage of GDP

As the figure shows, the Russian loan reaches its maximum in 2026, when the second block is completed, then it gradually wears off by 2046. In contrast, the own resource part, which is as high as EUR 6 billion at the completion of the project, continues to increase faster after the start-up of the facility than nominal GDP growth. This is because we assume that the real interest rate will exceed real growth, as experience indicates it tends to. Naturally, the proposition that the cumulative stock of loans directly related to the investment will exceed 50 per cent of the nominal GDP of the time by 2086, when the reactors are decommissioned, is hypothetical in the sense that this would be the amount of increase in the debt ratio in 70 years if the NPP had no direct or indirect effect on either growth or fiscal revenues.

Below we shall examine the revenues that the Government can use to offset this enormous hypothetical debt growth.

4.2 Property income

There are the following flows of funds between the State and the NPP:

1. The State increases equity in the NPP simultaneously with the investment
2. The NPP makes payments into the state-run decommissioning reserve
3. The NPP pays corporate profit tax to the State
4. The NPP pays dividends to the State
5. The State may withdraw equity from the NPP

Of these, item 1 is the investment itself, items 4 and 5 constitute property income. In order to determine the maximum amount of dividend and equity that can be withdrawn from the NPP, first we have to calculate the pre-tax profit of the NPP.

[26] Values shown as a percentage of GDP relate to the nominal GDP in the baseline, and take no account of the effect on the level of GDP. Firstly, the resulting error is insignificant, secondly, the denominator needs to be the same if we are to add up the various effects, and thirdly, the various effects have different signs, thus the error is reduced even further if their resultant is calculated

The following expenses are deductible for the purposes of calculating the pre-tax profit:

1. cost of fuel and waste management
2. operational costs (we assume that the value of maintenance is capitalised by the NPP on an ongoing basis and later deducted in the form of depreciation)
3. payments into the decommissioning reserve
4. depreciation (original investment + maintenance costs)

Naturally, the corporate profit tax and the profit tax on energy suppliers ('Robin Hood tax') must also be deducted from after-tax profits. We assume that both will remain unchanged throughout out time horizon (19 and 31 per cent, respectively).

As we assume that the NPP will be able to sell all the electricity it generates at the prevailing market price, its net sales revenue depend only on the market price and on capacity utilisation.

4.3 Indirect effects and the macro-level rate of return of the project

In addition to the direct payments of the NPP to its owners, the project may also have an indirect effect on the budget as it also pays taxes and stimulates general economic activity through its chain of suppliers. GDP-increasing effects may present themselves through two channels: the value added by the NPP itself and the domestic value added by suppliers (during both the investment phase and the operation phase).

4.3.1 Effect of the project on GDP

In the operational phase the gross value added[27] by the NPP is expected to be around HUF 150-200 billion annually, at current prices. This, however, does not necessarily entail a GDP growth of the same size on the level of the whole economy because most of the electricity generated by the NPP --– two thirds, assuming that the current ratios remain – is used by other manufacturing companies, that is, only one third of the output serves the purpose of final use. However, as we assumed that by the time the new plant starts production, the Hungarian electricity grid will be fully integrated into the European network, there will be no crowding-out effect: the electricity that is not needed in the Hungarian market can be exported (without any limitation under our assumption) at the prevailing European market price.

The gross value added by the NPP is expected to be around HUF 150 billion annually at current prices. Naturally, this will represent a gradually decreasing ratio of GDP as calculated in the baseline scenario.

In the manner described above, we estimated the local value added throughout the investment period.

	2018	2019	2020	2021	2022	2023	2024	2025	2026
Together	126	119	61	32	40	27	46	24	31
Factory equipment costs	0	0	0	0	0	0	0	0	0
Site labor costs	86	96	39	28	35	22	38	20	25
Site material costs	40	22	22	3	5	5	8	4	5

Table 5: Local value added relating to the investment, at current prices (HUF Bn)

The third channel contributing to GDP growth is the domestic value added by suppliers during the

[27]The value added is the net sales revenue and the capitalised value of work performed by the undertaking for its own purposes (in our case, the refurbishments), minus material expenditures (which include, *inter alia*, fuel costs, but not labour costs).

operational phase. As a simplification, we assumed that the NPP will purchase all of the fuel and the waste management service abroad, as well as 60 per cent of the other material expenditures. The remaining part is sourced locally, which has a value added content of 40 per cent – another simplified assumption.

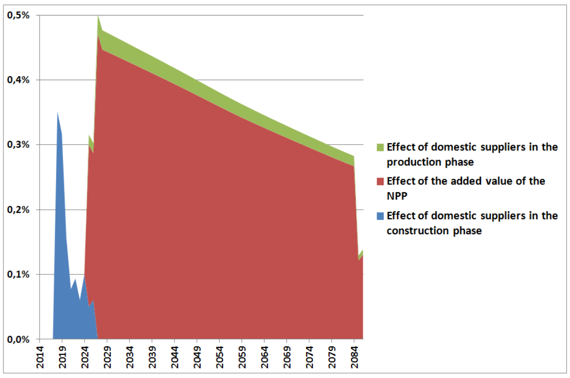


Figure 6: Effect of the project on GDP

4.3.2 Tax payments of the power plant

The main tax payment obligations of the NPP:

VAT:

The net VAT revenue from the NPP is proportionate with the value added by the NPP, as the company gets a refund of the VAT on intermediate consumption. Assuming that the current VAT rate of 27 per cent remains in place, additional tax revenue of around HUF 10-15 billion is generated annually.

Taxes on labour:

Additional tax revenue is generated in proportion to labour costs. Considering that most of the employees of the NPP would not be out of work even in the absence of the project (at worst they would earn a lower salary)[28], we calculated with a 25 per cent tax wedge instead of the 50 per cent that would result from the statutory rates.

Corporate profit tax:

It is calculated as a proportion of the pre-tax profit, at the prevailing rate of 19 per cent (which is assumed to stay in place).

Profit tax on energy suppliers:

Similarly to the corporate profit tax, it is calculated as a proportion of the pre-tax profit, at the prevailing rate of 31 per cent (which is assumed to stay in place).

Payments into the decommissioning reserve

Calculated as a percentage of the electricity generated Its level is determined by the decommissioning costs estimated based on international figures and the expected development of interest rates, so that the payments including compound interest exactly cover the inflation-adjusted nominal value of the decommissioning costs at the end of the production period.

The two figures below show the state revenues from the NPP in nominal terms and as a percentage of GDP.

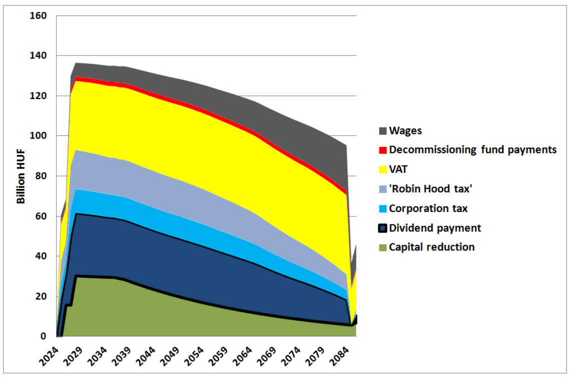
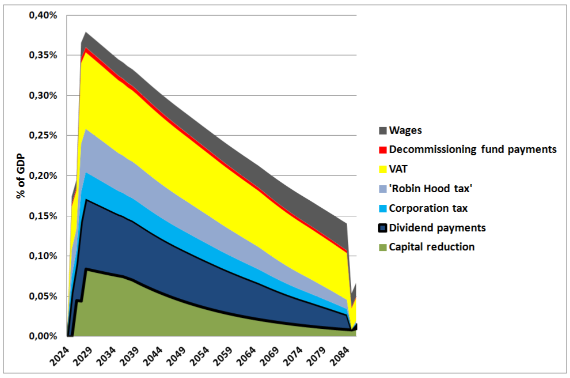


Figure 7: Payments by the NPP in the period of operation at 2014 prices (electricity price at 2014 prices: 43 EUR/MWh)

[28]The average salary of the employees of the Paks Power Plant was twice the average income measured in the energy sector (HCSO) in 2013 (weighted for the ratio of blue collar/white collar workers)



8. Figure 8: Payments by the NPP in the period of operation as a percentage of GDP (electricity price at 2014 prices: 43 EUR/MWh)

4.3.3 Hungarian suppliers in the investment and operation stages

As we have no information on the internal breakdown of domestic supplies, we approximated tax revenue as 40 per cent of the total value added.[29] Budgetary revenues are expected, approximately, to be HUF 50 billion in the first two years of the project (when the GDP effect shown in Figure 6 reaches 0.30-0.35 per cent, or HUF 100 billion at current prices), to decline to the HUF 10-20 billion range in subsequent years. As a percentage of GDP, this represents a gradually declining contribution to the gross domestic product.

5 EFFECT OF THE PROJECT ON OTHER BUDGET INDICATORS

5.1 Primary balance

The Maastricht primary balance (net of interest) is not affected by an equity reduction as it cannot be recognized as an income item. The figure below show the items, as a percentage of GDP, that have a direct effect on the Maastricht primary balance.

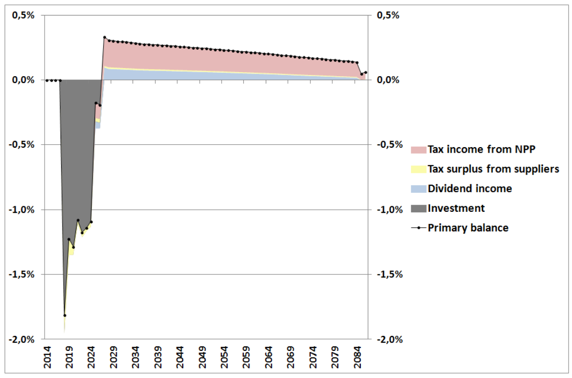


Figure 9: Items affecting the Maastricht primary balance as a percentage of GDP (electricity price at 2014 prices: 43 EUR/MWh)

5.2 Public debt

Gross public debt is increased by the 'Russian' and 'Hungarian' investment loans, and reduced by the items detailed above as improving the primary balance. As we assume that the state will not spend these additional revenues, their debt reducing effect will be enhanced by the interest and compound interest on the savings.

To facilitate the understanding of the charts, we first present only the effect of property income.

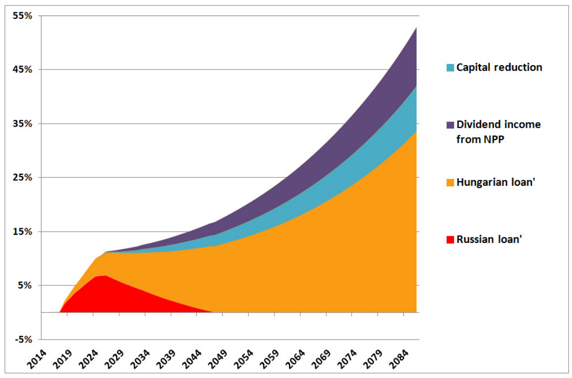


Figure 10: Effect of property income on the Maastricht debt as a percentage of GDP (electricity price at 2014 prices: 43 EUR/MWh)

[29] The assumption is based on the fact that at present the total central tax revenue is around 40 per cent of GDP

The top curve of the above figure is identical with the top curve of Figure 5 as the borrowings for the purposes of the project are given. While no income reduced the public debt in the previous figure, here the effects of the dividend and the equity reduction are present. The aggregate growth of public debt is indicated again by the top boundary of the orange band, but this is lower than in the previous figure as the disinvested equity and the dividend income cover some of the borrowings. It can be seen that in the event of the selected 43 EUR/MWh electricity tariff, property income fails to cover investment costs: from the aspect of the investor, the return on the investment is negative.

If we take into account the tax payments of the NPP and of the suppliers, as well as the interest accruing on these payments, the return on the project is more favourable. As the figure shows, at the carefully selected electricity price (43 EUR/MWh), exactly enough net assets (negative debt) remain on the hands of the state at the end of the production cycle to cover the decommissioning costs at the prices prevailing at that time. This means that, in view of all the direct and indirect fiscal effects, the project breaks even for the state.

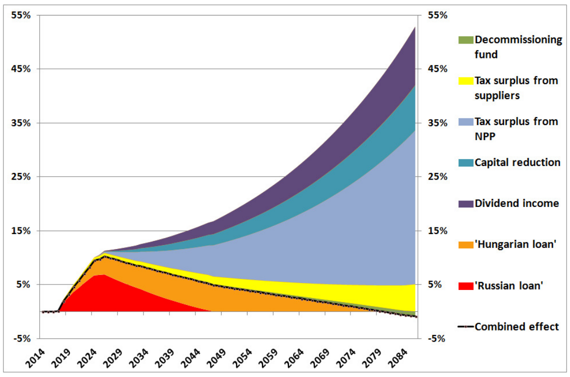


Figure 11: Total effect of the project on public debt as a percentage of GDP (electricity price at 2014 prices: 43 EUR/MWh)

As the figure shows:

1. there is no Russian loan after 2046 but the project continues to increase the debt ratio relative to the baseline scenario for another 40 years.

2. Until 2086 reserves corresponding to around 0.5 per cent of the GDP of the time will have accumulated for decommissioning, which can be used to reduce the gross public debt up to that point, whereas after 2086 this sum will actually have to be paid, thus it cannot be taken into account for the calculation of the rate of return of the project in economic terms.

5.3 Maastricht balance

Investment expenditures, additional tax revenues, the various interest expenditures and revenues, payments into the decommissioning reserve and dividends paid by the NPP[30] in aggregate alter the (Maastricht) fiscal balance as a percentage of GDP as shown in the figure below:

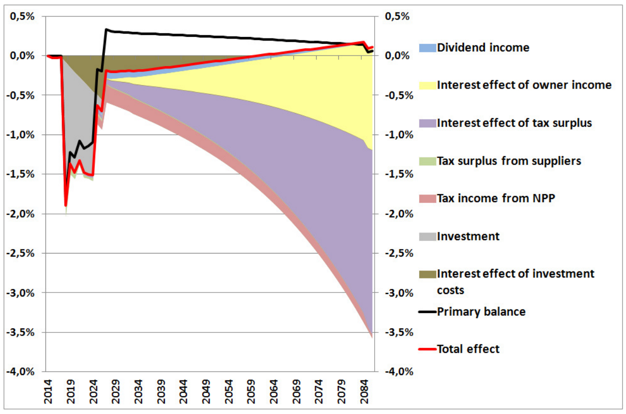


Figure 12: Total effect of the project on the primary and total fiscal balance as a percentage

[30] Of property income, the equity withdrawn cannot be recognized as budgetary income in accordance with the statistical methodology of the EU.

of GDP (electricity price at 2014 prices: 43 EUR/MWh)

As the above figure shows, in the period of investment the negative effect amounts to 1.5-2 per cent of GDP, then when electricity generation starts, the effect on the primary balance (black line) becomes positive. The effect on the total balance continues to be negative for quite a while due to interest expenses. As time passes, the primary balance effect decreases while the interest effect becomes increasingly positive. Naturally, these values do not contain the effects of any potential measures that are required to comply with Hungarian or EU fiscal rules.

5.4 The rate of return of the project at different electricity price levels

In the previous chapters we assumed that the price of electricity will stabilise at a real level (43 EUR/MWh) where the state as both investor and tax collector breaks even on the whole project at the real interest rate of 4 per cent. In other words, the 43 EUR/MWh electricity price assures a 4 per cent real rate of return for the state. If we change our assumption for the yield curve and increase or decrease the required yield, the electricity price necessary for the various required yield levels can also be calculated.

The figure below shows two curves. One ('state level') shows the necessary electricity price for a given real yield requirement, taking into account the effects of tax revenues. The other one ('investor level') takes only property income into account.

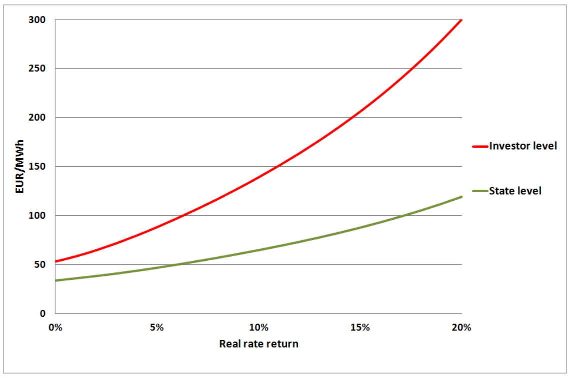


Figure 13: Electricity prices required for various required rates of return, on the level of the state and of the investor

Naturally, a substantially higher electricity price is required for the project to yield a positive return on the investor level. For instance, for a rate of return of 4 per cent, an electricity price of 43 EUR/MWh is sufficient on the state level, while 80 EUR/MWh is necessary on the investor level.

To assure the comparability of our results, in the figure below we compared our calculations for the investor level with the results of the analysis of the Regional Centre for Energy Policy Research (REKK) published in the spring of 2014.[31]

[31] As the REKK reckoned with a corporate profit tax of only 16 per cent in its calculations (black line), we performed the calculations at a corporate profit tax rate of 50 per cent (blue line) using the Excel sheet made available on the website of the institute

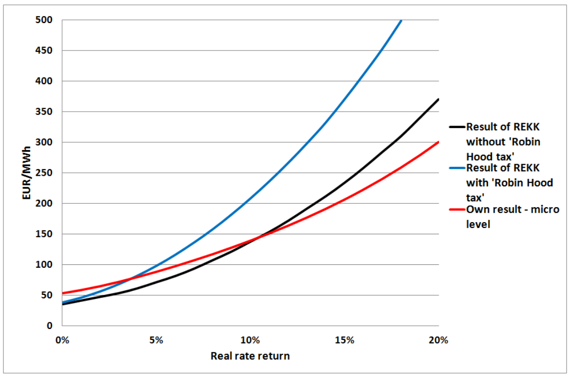


Figure 14: Electricity prices required for various required rates of return, on the level of the investor

The figure lends itself to three conclusions:

1. At the selected 4 per cent rate of return, the two models yield very similar results (80 and 82 EUR/MWh).
2. At the electricity price of 90 EUR/MWh expected by the Government, both model results in a real yield of around 5 per cent on the investor level
3. At the prices prevailing on the European open market, the rate of return of the project is negative in both models.

6 EFFECT OF THE PROJECT ON THE FISCAL MARGIN OF DISCRETION

6.1 The statistical treatment of the project

The effective EU rules governing statistical recognition, which determine the effect of the project on the Maastricht balance and the public debt, are clear enough that the project should be classified in the government sector, but unfortunately experience shows with projects of this magnitude, political considerations come into play. As high-volume energy investments are being considered in several Member States, the rules governing their accounting treatment may change in the future.

There are a number of considerations that all indicate that the project will worsen the balance and debt ratio of the government sector. Most notably, on the investor level the project is unable to produce the real yield that would be required under market conditions. Naturally, as shown in the previous chapter, real yields of any size may be calculated if sufficiently high electricity prices are assumed, but it is practically out of the question that the Eurostat would disclose the maximum electricity price that it would consider to be an admissible assumption. In such a case the question of the ROI of the project could degrade into a theological debate.

Under a different rationale, however, experts think that Eurostat will not engage in polemics on the financial rate of return of the project. Instead, it will take the position that the mere size of the project clearly shows that it will be implemented based on a government decision and under government control, at the ultimate risk of the state, thus in effect it constitutes public investment, therefore it must be recognised in the financial statements of the state. This interpretation is rendered more plausible by the fact that the investment loan is taken out by the state itself from the Russian government.

In the foregoing we will consider that the accounting treatment of the project is clear enough, and no accounting gimmicks that would assure more favourable statistical treatment but worsen the efficiency of the project make any sense.

Even though our results indicate a realistic probability that the project may break even on the level of the state, taking into account the additional tax revenues and at electricity prices slightly higher than the present level, **substantial fiscal adjustments will be called for in the investment period covering the first ten years, irrespective of electricity prices, to compensate for the increase of the debt ratio.**

6.2 The macroeconomic effects of some potential fiscal measures

Under the effective Hungarian and EU fiscal rules, there is no leeway in the fiscal baseline scenario for the financing of the Paks investment by the state. We analysed scenarios with different potential measures and the magnitude of adjustments required relative to the baseline scenario – taking into account the second-round fiscal effects of the measures themselves through altering the macro path.

We looked at the following potential fiscal measures:

1. Introduction of a consumption-type temporary 'Paks tax' (approx. raising the 27 per cent VAT rate to 35 per cent)
2. Welfare transfers: expenditures totalling around HUF 4500 billion would have to be reduced by HUF 700 billion at current prices (we assume that half of the transfers would effect educated and active households, the other half uneducated and/or inactive household)
3. Reduction of amounts spent on government consumption and/or investment[32]
4. Reduction of support to the investments of the private sector (including foreign investors)

[32] In this context we deem government investment to mean projects which contribute to GDP only through the own value of the investment but do not improve the productive efficiency of the private sector, for instance

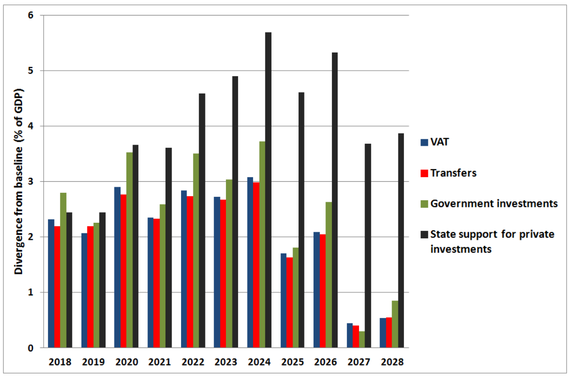


Figure 15: Cumulative gross level of the required adjustment for different types of measures

Naturally, measures amounting to 3–4 per cent of GDP (gross) would bring about substantial output losses. The figure below shows the estimated effect of the above measures on output.

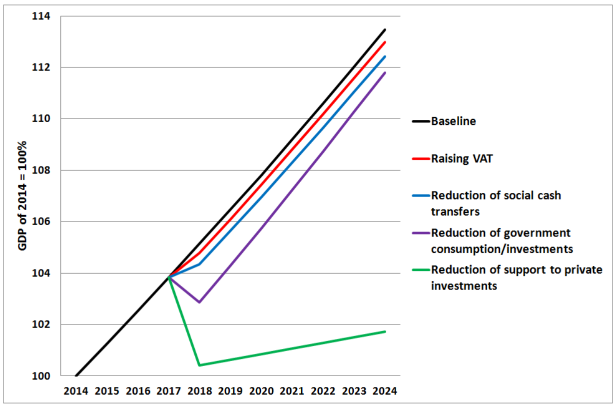


Figure 16: Output losses attributable to the adjustments in the investment period, for different measures (Note: smooth curves between 2018 and 2024)

The divergence of the growth paths resulting from the various measures from the baseline is considered the output loss.

In the state-level rate of return calculations we took into account the various indirect tax revenues, but if we want to analyse the entire economy, we also need reckon with the part of the value added through the construction of the

NPP that is not centralised by the State. There are three such items to consider:

1. 60 per cent of the value of supply in the investment phase (present value around HUF 200 billion)
2. 60 per cent of the value of supply in the production phase (present value around HUF 100 billion)
3. 50 per cent of the net wages of employees of the NPP (present value around HUF 150 billion)

At a discount rate of 4 per cent, the present value of these three items is in the order of HUF 450 billion. In the investment stage, together with the output loss resulting from the corrective fiscal measures,[33] the following aggregate values are obtained.

	Gross value of measure in 2018 at current prices (HUF Bn)	Present value of output loss in 2014 (HUF Bn)	Present value of output gain in 2014 (HUF Bn)	Net effect at present value in 2014 (HUF Bn)	Required electricity price (EUR/MWh)	'Discount rate equivalent' (illustration)
Consumption tax increase	850	-900	450	-450	48	5,7%
Reduction of social cash transfers	850	-1800	450	-1350	58	8,4%
Reduction of government consumption/investme	1000	-3500	450	-3050	76	12,7%
Reduction of support to private investment	900	-15450	450	-15000	206	31,4%

Table 6: Output loss from the various offsetting measures

If, for instance, the Government were to create the fiscal latitude required for the nuclear power plant project by increasing consumption taxes, the output loss would be around HUF 450 billion at 2014 prices: in the investment stage the loss would be HUF 900 billion, which is partly offset by the uncentralised part of the excess GDP generated by the project, in the amount of HUF 450 billion. If cash transfers are curtailed, the loss is three times greater at HUF 1350 billion. If the project is to compensate for these losses, higher electricity prices must be assumed. In the scenario of consumption tax increases it is sufficient to raise the price by EUR 4.5 to 48 EUR/MWh, but if the new nuclear power plant displaces incentives to private investment, a price above 200 euro is needed for the project to yield a positive return on the level of the entire economy. Naturally, these calculations do not reckon with the fact that a market electricity price of 200 EUR/MWh in itself would dramatically curb growth.

By way of illustration, instead of working with the electricity prices necessary in the case of various measures, we can convert our results into discount rates: if, for instance, we know that the Government will create the necessary fiscal margin by cutting social cash transfers, then instead of looking at social return, it is sufficient to examine the return on the state level but with a discount rate of 8.7 per cent rather than 4 per cent. It is obvious that these illustrative equivalent discount rates are practically at the level generally found in the private sector.

6.3 Fiscal policy conclusions

From the aspect of the investor, the project will not produce a positive return at the current electricity prices.

For the project to generate the real yield of long-term government securities required as a multi-

[33]For the calculation of the output loss, we made the highly optimistic assumption that the adjustment measures can be abandoned at the end of the investment phase and that real GDP level will immediately leap back to the baseline path

decade average (4 per cent) on the state level, taking into account indirect and second-round tax revenue effect as well, electricity prices must be slightly higher than the current Central European level (35-36 EUR/MWh), at around 43-44 EUR/MWh (at 2014 prices, that is, adjusted for inflation in later years). According to international forecasts, this is not an unrealistic assumption, but it makes the project break even only at the expected value; it contains neither the risk premium expected from any high-risk investment nor a reserve for the eventuality of a time or budget overrun.

We must be aware that if the project has a negative rate of return based on the prevailing European market electricity prices, then a potential boom in Hungarian growth would not resolve this problem as we started from the assumption that there would be no constraints to the international trade in electricity. Such losses are easier to tolerate for a strong economy, but this fact does not turn a loss into a profit.

In the period of the investment the debt ratio rules that would be effective in the absence of the project would be compromised; consequently, measures are called for.

A margin of discretion corresponding to HUF 400-450 billion at current prices must be created with long-lasting measures to cover the divergence from the baseline for 6–8 years. Measures of this magnitude tend to result in significant output losses.[34] Taking into account the output gain resulting from the establishment of the NPP, a higher electricity price must be assumed if the project is to generate a positive return for the whole economy (at a 4 per cent discount rate).

If measures directly affecting a broader scope of citizens are implemented (increase of consumption taxes, reduction of social cash transfers), the net output loss can be offset even at a price level around 50-60 EUR/MWh, but if government consumption is reduced, an electricity price of almost 80 EUR/MWh, and if private investments are crowded out, 200 EUR/MWh, is necessary. Obviously, growth prospects are worsened less if the state makes adjustments while shifting public and/or private expenditures towards investments.

Privatisation could be an alternative solution, but even the sale of the entire public shareholding in MOL would not be sufficient to offset a single year. The partial privatisation of MVM would be adequate in terms of volume, but this is outside the remit of this paper.

Whatever the Government's decision on the adjustment measures, the question remains: **if a fiscal margin of discretion of HUF 400-450 billion net can be created in the long run, should it really be used to finance an investment project of the Paks type?**

This is a project that will be present in the economy only as an investment for at least 8 years (during this time, its economic impact is the same as if statutes of Kossuth were being erected – 90 per cent of them imported), and its subsequent return has significantly higher-than-average risks as energy prices are relatively volatile.

[34] By comparison, we can contrast the growth estimates for 2011–2015 found in convergence programmes, which contain the figures envisaged by the Government. After the Government made gross adjustments of approximately HUF 1200-1500 billion, corresponding to 4–5 per cent of GDP, in 2012, the differences between the figures of the spring 2011 and spring 2014 convergence programmes indicate that the Hungarian economy lost 30 per cent of GDP, in the order of HUF 9 thousand billion at current prices, in the four years between 2012 and 2015

The Government will have to come forth with its plans in the convergence programme of the spring of 2015 unless it proposes to postpone the project. The longer the uncertainty, the greater the output loss due to the required fiscal measures is likely to be.

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ANNEXES

Assumptions underlying the calculations

Assumed parameters of the investment, refurbishment and decommissioning

	Parameter	Value of parameter
Investment		
	Total investment cost at nominal value (EUR Bn)	12,5
	Year of start of investment ('first pour of concrete')	2018
	Year of completion of investment	
	Block 1	2024
	Block 2	2026
	Total investment cost at present value in 2014 (EUR Bn)	
	Share of Hungarian suppliers in the investment	
	Factory equipment cost	0
	Site labour cost	40%
	Site material cost (net of import content) *	20%
Refurbishment		
	Regular refurbishment expenditure at constant 2014 prices (HUF Bn / year/ reactor) **	5,9
Decommissioning		
	Year of end of operation of block 1	2084
	Year of end of operation of block 2	2086
	Decommissioning costs relative to total electricity generated (HUF/MWh)	593
	Total electricity generated (TWh/reactor)	485
	Decommissioning costs per reactor at 2014 prices (HUF Bn)	288
Notes		
*	As the import content of Hungarian investments is above 50% on average, a 20% contribution to GDP clearly requires the ratio of	
**	We assumed that no major refurbishment or service life extension would occur.	

Assumed economic parameters of electricity production in the Paks 2 power plant

Parameter		Value of parameter
Technical parameters of electricity production		
	Type of power plant	VVER-1200 (V491)
	Number of reactors (units)	2
	Gross rated capacity per reactor (1)	1170
	Net rated capacity per reactor (2)	1085
	Heat production from uranium (MWth-day/kg) (3)	60
	Efficiency of turbines (4)	0,339
	Volume of electricity generated from 1 kg of fuel (MWh/kg)	488
	Uranium requirement at 100% capacity utilisation (kg/year/reactor) (5)	19484
	Service life of reactor (year)	60
	Capacity utilisation rate of reactors	85%
	Total electricity output (TWh/year) (6)	16,2
Cost of energy production		
	Market price of uranium at 2014 prices (EUR/kg) (7)	1952
	Cost of waste management at 2014 prices (EUR/kg)	1470
	Unit cost of fuel and waste management (USD/MWh) (8)	7,02
	Number of employees at NPP (persons)	1500
	Average labour cost per person (thousand HUF/person/month)	1137
	Total labour cost for 2014 (HUF Bn/reactor)	10,2
	Indexation of real value of labour cost (9)	~2%
	Material expenditures at 2014 prices (HUF Bn / reactor)	22,4
Effect of energy production on GDP		
	Share of macro-level effect on GDP within the value added by the NPP	100%
	Import content of the material expenditures of the NPP	40%
	Value added content of the domestically sourced material expenditures of the NPP	40%
	Import content of refurbishments	60%

Notes:	
(1)	http://www.iaea.org/NuclearPower/Downloadable/aris/2013/36.VVER-1200(V-491).pdf
(2)	http://www.iaea.org/NuclearPower/Downloadable/aris/2013/36.VVER-1200(V-491).pdf
(3)	http://www.tvel.ru/wps/wcm/connect/tvel/tvelsite.eng/resources/b00eb08047178c38abfbfb39942cc531/brochure_nuclea_eng.pdf
(4)	http://www.iaea.org/NuclearPower/Downloadable/aris/2013/36.VVER-1200(V-491).pdf
(5)	http://www.academia.edu/3927198/Cost_of_Electricity_from_the_Jaitapur_Nuclear_Power_Plant
(6)	In 2012 domestic electricity consumption in Hungary was 35.5 TWh.
(7)	http://www.world-nuclear.org/info/Economic-Aspects/Economics-of-Nuclear-Power/
(8)	http://www.iea.org/publications/freepublications/publication/name,43546,en.html (p. 59)
(9)	In line with macro-level productivity growth

Macroeconomic and fiscal parameters

Parameter		Value of parameter
Macroeconomic parameters		
	Real GDP growth per person	1,70%
	Real GDP growth per active-age person	Acc. to demographics
	Inflation	
	Forint	3%
	Euro	2%
	Real appreciation of the forint	0%
	Increase of electricity price above inflation	0,00%
	Exchange rates	
	HUF/EUR exchange rate in 2014	305
	HUF/USD exchange rate in 2014	229
	Real discount rate (cost of funds to the Hungarian State)	4,00%
Taxation parameters		
	VAT rate	27%
	Cost of labour to employer (1)	50%
	Corporate profit tax rate	19%
	Profit tax on energy suppliers ('Robin Hood tax')	31%
	Average tax content of value added by suppliers	40%
	Depreciation of initial investment (year) (2)	60
	Depreciation of ongoing refurbishment (year) (3)	10
Parameters of the financing of the investment		
	'Russian loan'	
	Facility (EUR Bn) (4)	10
	Disbursement schedule	
	Interest	
	2016-2025	3,95%
	2026-2032	4,50%
	2033-2039	4,80%
	2040-2046	4,95%
	Repayment schedule as % of the disbursed amount, per year	
	2026-2032	3,6%
	2033-2039	5,0%
	2040-2046	5,7%
	Supplementary loan	
	Amount (HUF loan at EUR Bn equivalent) (4)	2,5
Notes:		
(1)	We assume that only half of this will represent additional revenue relative to the baseline	
(2)	The NPP will amortise only 90 per cent of the initial investment	
(3)	We assume that the technical content of ongoing refurbishments is split between machinery and software at a ratio of 2:1.	
(4)	Disbursement parallel with investment	

Hypothetical income statement of the power plant

Hypothetical income statement of the NPP calculated for energy units, at 2014 real value (assumed electricity price: 13.21 HUF/kWh = 43 EUR/MWh)

	2026	2056	2086
Income			
Net sales revenue	13,21	13,21	13,21
Interest income	0,14	0,07	0,06
Total income	13,35	13,28	13,27
Expenditure	0,00	0,00	0,00
Fuel and waste management	2,14	2,16	2,17
Labour cost	1,65	3,07	5,84
Material cost	2,78	2,78	2,78
Tax paid towards decommissioning costs	0,14	0,14	0,14
Depreciation of initial investment	2,67	1,10	0,45
Depreciation of refurbishment	0,07	0,62	1,17
Interest expenditure	0,00	0,00	0,00
Total expenditure	9,44	9,85	12,54
Profit before tax	3,91	3,43	0,73
Corporate profit tax	0,74	0,65	0,14
Robin Hood tax	1,21	1,06	0,23
Dividend + advance on dividend	1,95	1,71	0,36
Tax + dividend payment	3,91	3,43	0,73
Profit for the year	0,00	0,00	0,00

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