INSTITUTE FOR ECONOMIC RESEARCH AND POLICY CONSULTING
IN UKRAINE
GERMAN ADVISORY GROUP ON ECONOMIC REFORM
Reytarska 8/5-A, 01034 Kyiv,
Tel. (+38044) 278-6342, 278-6360, Fax 278-6336
E-mail: institute@ier.kiev.ua, http://www.ier.kiev.ua

W3

Energy Price Shocks and Market Reforms:
A quantitative Assessment

Executive Summary

The recent energy price shocks require appropriate policy responses. Obviously, under the status quo – characterized by predominantly state-owned enterprises, frequent political interventions, final prices set at below cost levels, delayed investments, low service quality, high dependency on imported fuels, etc. – Ukraine is unlikely to overcome the negative impact of higher prices by increasing energy efficiency and securing future supplies. Accordingly, the government considers initiating more market-oriented energy policies and expressed its intention to reform the energy sector in line with EU principles and to join the Energy Community Treaty. However, a concrete agenda has not yet been developed. In particular, the fear of rising domestic prices has stimulated active political opposition while the related political discussion suffers significantly from a lack of (quantitative) understanding of the economic effects and impacts of current and future energy price shocks and the extent to which market reforms are capable to overcome negative consequences.

In an attempt to close this gap, our paper undertakes an quantitative assessment of the extent and impact of current and future energy price shocks as well as of the potential of market-oriented reforms to mitigate negative consequences. We argue that currently and in the near future Ukraine faces two significant energy price shocks. The first, an increase in gas prices, has been already felt, but further increases are still yet to come. The second, a strong increase in electricity prices, also started in 2006 and must be expected to continue over the next five years as most of Ukraine's existing generation capacities have long outlived their design life. Given the crucial importance of electricity supply for supporting the strong growth of the economy there is an urgent need for new capacities which can only be financed by means of higher prices.

Together, both shocks can significantly slow down economic activities. Fortunately, Ukraine's energy sector still restrains significant growth potential. For example, private investments and competition can reduce losses and increase productivity, and hence stimulate energy efficiency. Moreover, Ukraine's natural gas deposits constitute a valuable asset, which so far has not been used up to its maximum economic potential. In model-based simulations we show how policy-induced productivity increases together with profit-maximizing use of natural gas reserves can significantly mitigate the negative consequences of energy price shocks while setting the economy on a more sustainable growth path.

Contens

1 Introduction / Motivation

Recent significant energy price shocks on Ukraine's economy require appropriate policy responses. Obviously, under the status quo – characterized by predominantly state-owned enterprises, frequent political interventions, final prices set at below cost levels, delayed investments, low service quality, high dependency on imported fuels, etc. – Ukraine is unlikely to overcome the negative impact of higher prices by increasing energy efficiency and securing future supplies. Accordingly, the government considers initiating more market-oriented energy policies and expressed its intention to reform the energy sector in line with EU principles and to join the Energy Community Treaty. However, a concrete agenda has not yet been developed. In particular, the fear of rising domestic prices has stimulated active political opposition, while the related political discussion suffers significantly from a lack of (quantitative) understanding of the economic effects and impacts of current and future energy price shocks and the extent to which market reforms are capable to overcome negative consequences.

In an attempt to close this gap, our paper undertakes an quantitative assessment of the extent and impact of current and future energy price shocks[1] as well as of the potential of market-oriented reforms to mitigate negative consequences. In the next section we start by discussing the causes for future hikes of gas and electricity prices. We then lay out how we can model Ukraine's economy and simulate specific price shocks and policy responses. This is followed by presentation and discussion of results which finally enables us to derive relevant policy recommendations.

2 Ukraine's Energy Price Challenges

The current structure of Ukraine's economy has emerged on the basis of abundant energy supplies at low prices. Accordingly, a transition of energy prices towards internationally competitive levels constitutes major economic challenges. In this section we will argue that in the near future Ukraine will face two significant energy price shocks The first, an increase in gas prices, has been already felt, but further increases are still yet to come. The second, a strong increase in electricity prices, started in 2006 and must be expected to continue over the next five years as most of Ukraine's existing generation capacities have long outlived their design life. Given the crucial importance of electricity supply for supporting the strong growth of the economy, there is an urgent need for new capacities, which can only be financed by means of higher prices.

2.1 Gas Prices

During the past five years international gas prices have continuously increased, mainly driven by the link to crude oil prices in long-term contracts. As a result, the difference between import prices in Ukraine and their internationally competitive levels has more than doubled (Picture 1). At the same time, Russia/Gazprom are less willing to grant low prices to any of its neighboring countries, which in turn has dramatic consequences for the security of gas supplies in Ukraine. Since the Ukrainian-Russian gas conflict of January 2006 import prices of natural gas have increased to 95 USD/tcm on average and further in 2007 to 130 USD/tcm. Nevertheless, simple comparison with international price levels (Picture 1) shows that much stronger price increases are yet to come.

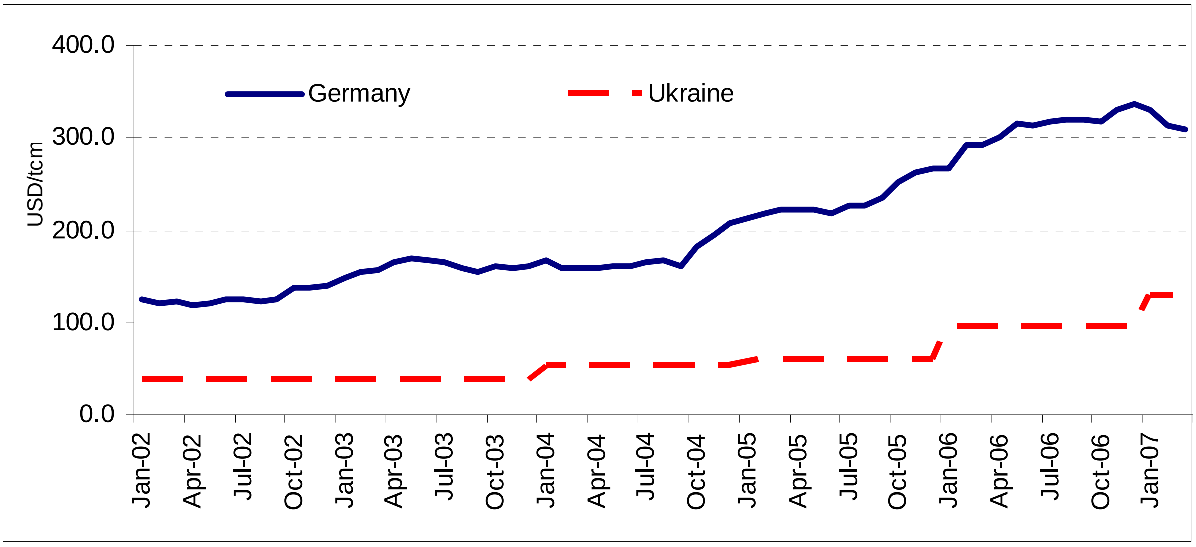
In our previous work we have estimated internationally competitive price levels for gas imports to Ukraine.[2] Medium-term price expectations on main EU gas markets such as Germany are about 250-230 USD/tcm. Subtracting estimated transit costs between Ukraine and Germany (30-50 USD/tcm) an internationally competitive price level for gas imports to Ukraine would be around 200 USD/tcm. Hence, we propose that some of the expected adjustments of gas import prices is still yet to come.

---

[1] The initial attempt to estimate the effect of the 2006 gas price shock was undertaken by the Institute for Economic Reserach and Policy Consulting. See "Macroeconomic impact of gas price shock" (IER Policy Paper V5, available online at http://www.ier.kiev.ua/English/papers/papers_eng.phtml

[2] See Policy Paper V12: Ukrainian Gas Imports: Towards secure and economically reasonable transactions. December 2006. The paper also includes estimates on expected import price levels for Ukraine.

Picture 1
Natural Gas Import Prices in Ukraine and Germany



Source: www.energate.de

2.2 Electricity Prices

For Ukraine's electricity sector, the main future challenges do not stem from higher gas prices but rather from the status of power assets. According to the CabMin's Energy Strategy to 2030 more than 92% of Thermal Power Plants (TPPs) have outlived their design live. Moreover, most of the existing Nuclear Power Plants (NPPs) are scheduled for decommissioning before 2020, and more than 30% of the high-voltage transmission lines have operated for 40 years or more and are in urgent need for replacement[3] Given the crucial importance of electricity supply for supporting the strong growth of the economy, there is a dramatic need for new investments, which can only be financed by means of higher prices. Estimates on long-run marginal costs of electricity generation can provide a good indication for necessary price levels. (Picture 2) gives an international overview on long-run costs of generating electricity by different types of technology (including costs estimates for rehabilitation of existing TPPs in Ukraine). Obviously, at present fuel prices, nuclear technologies come at lower costs than conventional technologies. Across the latter, coal-based generation technologies (excluding carbon costs), in particular Combined Heat and Power (CHP) plants[4], appear to have the lowest long-run marginal costs. It is also evident that no technology generates electricity for less than 200 UAH/MWh and no conventional technology for less than 250 UAH/MWh. A comparison with the average wholesale market price in Ukraine of 129 UAH/MWh in 2006 (or about 190 UAH/MWh in the "competitive" market segment") reveals the magnitude of the price shock that must be expected[5].

3 Economic Impact Assessment

3.1 Model Simulations

The magnitude of the expected price shocks for gas (times 1.5) and electricity (more than 2 times) is dramatic and leads to concerns about Ukraine's future economic performance. On the other hand, the efficiency of energy use is extremely low by international standards (see appendix picture A2) so that much – if not all - of the price increases could be compensated for by the use of more modern technologies. However, this would also come at the expense of higher capital costs.

In reacting to the challenges ahead the government of Ukraine considers initiating more market-oriented energy policies. It has therefore expressed its intention to reform the energy sector in line with EU principles and joint as an observer the Energy Community Treaty, a multilateral agreement of South - East European countries to build up a regionally integrated, competitive energy market based on EU principles. However, a concrete agenda has not yet

3 See also IEA: Ukraine – Energy Poliy Review. Paris.

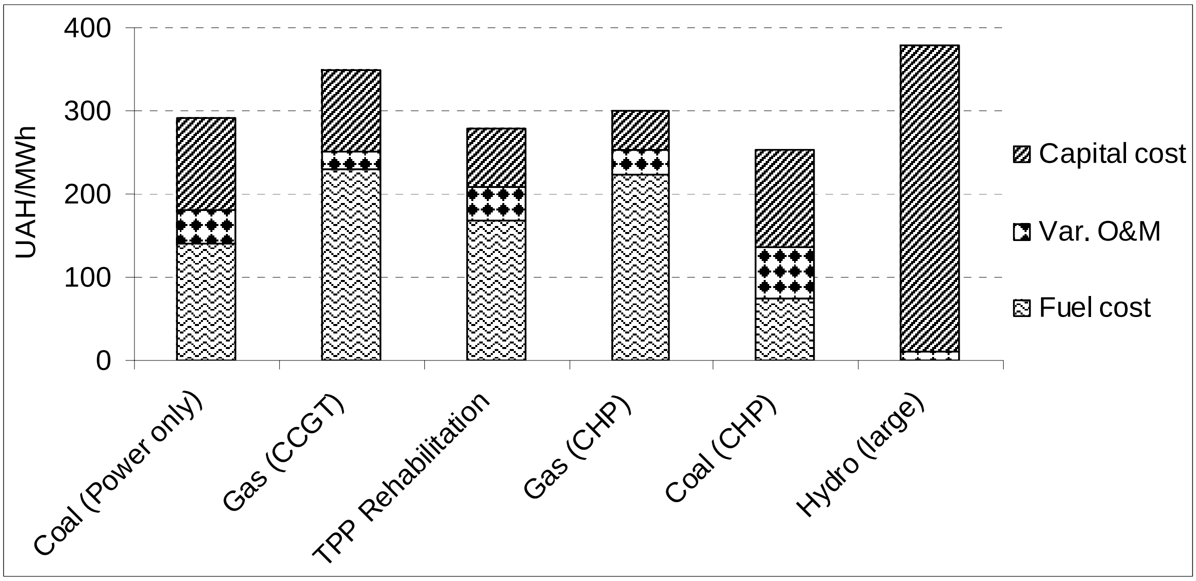
4 The value of generated heat (heat value) has been subtracted from fuel costs.

5 This assessment is even more dramatic if capacities are to be replaced by renewable fuels (see appendix).

been developed. In particular, the fear of rising domestic prices has stimulated active political opposition while the related political discussion suffers significantly from a lack of (quantitative) understanding of the economic effects and impacts of current and future energy price shocks and the extent to which market reforms are capable to overcome negative consequences.

Picture 2
Long-run Marginal Costs of Electricity Generation

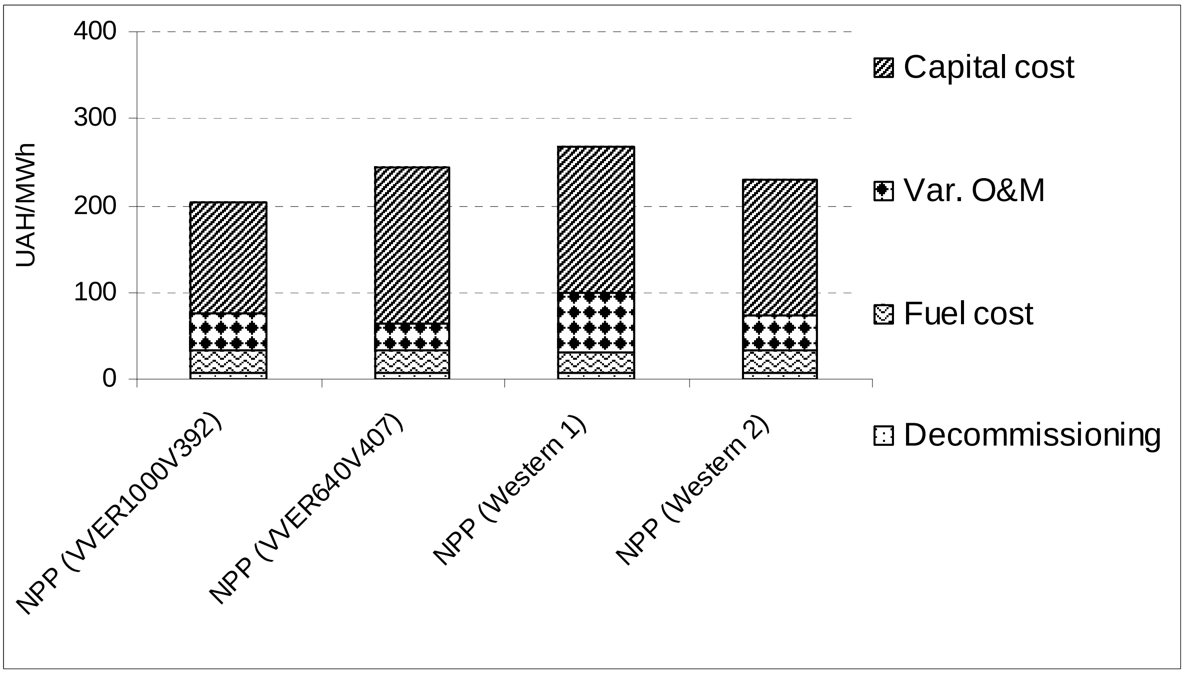
a) Non-Nuclear technologies [a]



[a] Excluding Carbon Costs

Sources: IEA: Projected Costs of Generating Electricity – 2005 update.
Own estimates on TPP Rehabilitation.

b) Nuclear technologies



* Russian Type 1: VVER1000V392
Russian Type 2: VVER640V407

Sources: MIT (2003): The Future of Nuclear Power – An Interdisciplinary MIT Study. Cambridge, MA, Massachussetts Institute of Technology.Rumiantseva and. Hirschhausen (2005).

Economics of Nuclear Power Development in Belarus. Energy Sector Reform in Eastern Europe Working Papers WP-EE-11 (www.ee2.biz)

To close this gap this paper estimates the impact of the expected energy price shocks as well as the extent to which losses can be compensated by means of market-oriented reforms in the energy sector or increased energy efficiency. We start from an economy-wide, quantitative model of Ukraine[6] and extend production functions further to allow for co-generation of electricity and heat substitution between capital and energy inputs[7]. The model allows us to simulate the impact of a particular event (shock) on the economy. By comparing the results of each such simulation with the initial situation (benchmark) we obtain an estimate of the relative economic impact of the simulated shock. Such a comparative - static analysis provides insights on how the economy will eventually adjust to the specified shocks at the end of a "reasonable" period of about 10 years. Details on the dynamics of the corresponding adjustment process are not analyzed.

The economy - wide scope of the model includes all sectors of production (including industries, agriculture, services etc.) as well as all public and private households as given in the National Accounts statistics. This ensures that all possible feedback effects such as the impact of higher energy prices on production costs of industry sectors and the corresponding impact on household incomes and consumption are simultaneously considered in a theoretically consistent manner.

In the benchmark scenario the model is calibrated to replicate the Ukrainian economy of 2004 as given by National Accounts Statistics and Ukraine's energy balance for the same year. All results presented below are therefore to be understood as changes relative to Ukraine's economic performance in 2004. To focus on understanding the impacts of simulated shocks we explicitly assume that no other external factors impact the economy. Hence, we do not consider the possible impact of other important developments such as changes in other world market prices of other commodities, changes in relative exchange rates (e.g. USD and EUR), population growth, research and development etc., which in reality are likely to occur at the same time. Hence, our results are to be understood as a simulation of the impact of expected energy price shocks rather than as a forecast of Ukraine's economic development over the next 10 years.

The shocks we simulate in our analysis are defined in the following scenarios:

1 **Gas Price Shock**: The price of gas imports increases from an average of about 60 USD/tcm in 2004 to 200 USD/tcm (3.3 times).

2 **Gas and Electricity Price Shock**: In addition to increased gas prices all existing thermal electricity plants as well as half of the installed nuclear capacities are replaced by new investments. The cost structure of the new units follows the estimates given in (Picture 2). A particular difference is that due to the much higher capital costs the share of capital in total revenues increases from 18% in 2004 to 60%. At the same time, total costs of generation increase by factor 2.4, which corresponds to a price increase from about 120 UAH/MWh in 2004 to 280 UAH/MWh (to ensure that prices cover the long - run costs of generation). At the same time, thermal efficiencies of the new generation technologies are also significantly higher: from 40% to 58% for gas (CCGT) plants and from 31% to 40% for coal units. Finally, newly installed CHPs use coal - fired technology and operate at a combined thermal efficiency level of 85%.

Price Shock and Energy Market Reforms: In this scenario the government undertakes three important measures in response to the price shocks:

- Market competition across electricity companies is strongly stimulated along the lines required by EU policy harmonization and the Energy Community Treaty, in particular the unbundling of vertically integrated monopolies, the establishment of regulated third-party access to networks and market opening for large scale consumers[8].

---

6 The model is a Computable General Equilibrium (CGE) model which was developed for assessing the economic impact of Ukraine's accession to the WTO on behalf of the Ministry of Economy and European Integration of Ukraine. It was developed jointly by the Institute for East European Studies (Munich), Copenhagen Economics (Danish consultancy) and the Institute for Economic Research and Policy Consulting. A technical description can be found in Pavel et al. (2005). Economic Impact of Ukraine's WTO Accession First results from a Computable General Equilibrium Model. IER Working Paper (www.ier.kiev.ua).

7 A general discussion on such extensions of a standard CGE model is given by Burniaux and Truong (2002). GTAP-E: An Energy-Environmental Version of the GTAP model. GTAP Technical Paper No. 16. Available at (www.gtap.org)

8 See GAG Advisory Paper V8: EU Energy Sector Reforms: A benchmark for Ukraine! for further details on principles and provisions of EU energy policies and how they stimulate competition.

Driven by these reforms, transmission losses are reduced (by 15%) and Total Factor Productivity (TFP) in the sector increases by 30%, based on quantitative evidence from the impact of those measures on electricity companies in the EU[9].

- The coal mining industry is reformed. In particular, wholesale coal prices are set by competitive auctions and fuel is no longer allocated to specific electricity plants by the government. Furthermore, the state eliminates all subsidies to coal mining. As a result, mining operators renew the existing technology which in particular raises the share of profits (capital) in value added to 20%.
- Domestic gas extraction in Ukraine is liberalized. This means that existing quotas and obligations which require the industry to sell to domestic customers (households) at regulated prices are abolished. Accordingly, Ukrainian gas producers are allowed to sell their gas at the highest possible price, which is set by gas export prices to EU markets. As a conservative estimate, this induces an increase in export prices of domestic Ukrainian gas by factor 3.5. However, exploiting Ukraine's gas reserves requires the companies to acquire licenses which the state sells in competitive auctions to all interested investors. The proceeds of this auction are used to finance the public budget and any budget surplus is given to private households by means of lump - sum transfers.

2 Previous Scenarios plus Increased Energy Efficiency: In response to higher gas and electricity prices the energy intensive industries (in particular chemical and petrochemical, iron and steel, non-metallic mineral industries as well as machinery) all increase the productivity of energy inputs by an average of 30% and financed by a corresponding increase in the share of capital in total revenues.

3.2 Results

The immediate effect of the two external energy price shocks is shown in Table 1 (scenarios 1 and 2). Driven by higher import prices, domestic gas prices almost triple. In addition, the replacement of depleted generation plants drives up electricity prices by more than two times. As a consequence of both increases, also heat prices go up sharply. As Table 1 demonstrates, none of the effects shown in scenarios 1 and 2 can be redone through market reforms (scenario 3) or increased energy efficiency (scenario 4). Accordingly, final energy consumption declines and remains at low levels in all four scenarios.

Table 1
Domestic Energy Prices and Consumption

	Benchmark	Gas Price Shock	Gas and Electricity Price Shock	Gas and Electricity Price Shock	Previous Scenarios plus Increased Energy Efficiency
	-0-	-1-	-2-	-3-	-4-
Energy prices (indices):					
- Gas	1.00	2.93	3.19	3.15	3.13
- Electricity	1.00	1.02	2.44	1.95	1.98
- Heat	1.00	1.66	1.95	1.91	1.91
Total Final Energy Consumption (TFC, in Mtoe)	84.6	54.3	54.3	66.6	64.6
- there off Gas	35.9	22.1	22.1	34.9	34.7
- there off Coal	11.1	4.3	4.3	4.9	4.5
- there off Electricity	10.3	11.2	11.2	9.3	8.8
- there off Heat	12.5	7.8	7.8	7.7	7.8

Note that the drastic decrease in final consumption of coal in scenario 1 is caused by a strong contraction in energy intensive industry, notably iron and steel, due to high gas prices. This results, however, is rather unrealistic as industries will of course increase efficiency of their energy use through investments. We have considered this in scenario 4.

Source: German Advisory Group

9 For example, since the start of energy sector reforms in the mid-1990s labor productivity of gas and electricity companies in the EU has increased from 3.6% to almost 6% per year (Commission of the European Communities (2004). Annual report on the implementation of the Gas and Electricity internal market. Brussels.).

While the sharp increase in prices appears to be unavoidable it is not obvious to establish the net economic impact of price shocks on industries and households. After all, higher prices do not only cause losses to consumers, but also create new economic opportunities which might add new value. This will be analyzed and discussed in the subsequent sections.

3.2.1 The General Picture

(Table 2) provides an overview on the macro - level impacts. As can be expected, both energy price shocks cause significant losses to the economy. The combined impact (scenario 2) reduces real incomes of urban and rural as well as of average and poor households[10]. Due to their specific consumption pattern, average urban households are slightly more affected (-17%) than average rural (-16%) while both encounter higher losses than poor households (-11% and -10%, respectively). Moreover, both price shocks cause a GDP loss (-10%) and a reduction in total value added by 15%. As for factor wages, higher energy prices stimulate the substitution between energy and capital (e.g. for financing energy efficiency investments). As a result, return to capital decreases at a lower rate than labor wages. Finally, higher prices for imported gas reduce the value of both, imports and exports.

Table 2
Macro-Level Results

	Benchmark	Gas Price Shock	Gas and Electricity Price Shock	Price Shock and Energy Market Reforms	Previous Scenarios plus Increased Energy Efficiency
	-0-	-1-	-2-	-3-	-4-
Welfare (change in real income, in %) of					
average urban households	-	-11	-17	-11	-10
poor urban households	-	-5	-11	-5	-6
average rural households	-	-10	-16	-9	-8
poor rural households		-5	-10	-4	-5
GDP Index (change in %)	-	-4	-9	-1	0
Value Added Index (change in %)	-	-10	-15	-8	-7
Real factor return (change in %)					
- Return to capital	-	-4.3	-8.8	-10.6	-8.0
- Wage rate, skilled labor	-	-12.3	-19.8	-14.5	-16.5
- Wage rate, unskilled labor	-	-14.3	-21.4	-15.8	-17.1
Aggregate export (UAH bn)	211	186.36	187.48	184.91	174.43
Aggregate imports (UAH bn)	185	159.62	152.94	151.75	141.32
Total exports (change in %)	-	-11.8	-11.2	-12.5	-17.4
Total imports (change in %)	-	-13.9	-17.5	-18.1	-23.7

Source: German Advisory Group

Results for scenario 3 demonstrate how market reforms can mitigate the economic losses from energy price shocks. In particular, about two thirds of the income decline of private households and almost the full decline in GDP can be compensated for. Investments in energy - saving technologies by industries (scenario 4) further harden this result. Apparently, the remaining losses of household income – from -4% for rural poor to -11% to average urban households – can be interpreted as the net impact of energy price shocks on private households, provided that politics (market reforms, scenario 3) and industry (energy efficiency, scenario 4) react appropriately. Compared to the dramatic initial price increases as reported in (Table 1) this appears to be a much smaller challenge, in particular if we recall that our simulations not explicitly address the significant potential for energy savings in the residential sector.

3.2.2 Energy Efficiency and Security

While it is clear that energy price shocks cause a reduction in energy consumption, it is less obvious to establish how strong the reduction will be. In other words, would the compensation

---

[10] A household is considered to be poor if its total expenditures are below 75% of the median total expenditures of all households.

for economic losses require Ukraine's economy to become one of the world's most energy - efficient ones, or would a rather modest adjustment be already sufficient? Our findings in (Table 3) provide some insights. Energy price shocks (scenario 2) reduce total primary energy supply (TPES) by almost 50%. After market reforms (scenario 3) and investments in energy efficiency by industries, TPES accounts for about 90 Mtoe, which is slightly more than 60% of the initial level.

Table 3
Energy Efficiency and Security

	Benchmark	Gas Price Shock	Gas and Electricity Price Shock	Price shock and Energy Market Reforms	Previous Scenarios plus Increased Energy Efficiency
	-0-	-1-	-2-	-3-	-4-
Total Primary Energy Supply (TPES, in Mtoe)	140.3	86.6	80.9	99.1	89.6
- there off Gas	65.9	33.7	31.5	46.1	46.0
- there off Coal	33.2	11.6	10.0	12.9	11.9
Energy Efficiency:					
- TPES/GDP (in toe /1000 USD)	2.2	1.5	1.5	1.7	1.5
- Electricity Production / GDP (in kWh/ USD)	2.8	1.7	1.6	1.8	1.7
Energy Import Dependency					
- Gas Imports/Gas Consumption	79%	33%	27%	18%	17%

Source: German Advisory Group

Initially, both energy efficiency indicators presented in the table (TPES/GDP and Electricity/GDP) reflect the rather wasteful use of energy in Ukraine's economy in the benchmark year. For example, every USD 1000 of GDP in 2004 required energy inputs of more than 2 toe. The higher energy prices in all four scenarios lead to significant improvements in both indicators (hence, less energy inputs per GDP). Nevertheless, indicator values between 1.5 to 1.7 for TPES/GDP and 1.6 to 1.8 for Electricity/GDP show that the results in Table 2 are based on energy efficiency levels which are still low by international standards. For example, in a sample of 49 industrial and transition economies (see Appendix) only Turkmenistan and Uzbekistan use more primary energy relative to their GDP while 39 countries including Bulgaria, Georgia and Poland need less than 1 toe to produce USD 1000 of GDP. Accordingly, the reduction of energy consumption as shown in Table 1 can be seen as rather modest by international standards. This demonstrates the strong potential that further efforts and modern technologies in other sectors, so far not covered in the analysis, are likely to have. Indeed, our Pictures clearly stress that increasing energy efficiency of Ukraine's economy is largely a process of catching up with existing technologies rather than one of developing new ones.

As a positive observation we note that all scenarios reduce Ukraine's dependency on gas imports from Russia, which allows the share of imports in domestic gas consumption to decline from 79% to as low as 20%.

3.2.3 Sectoral Effects

A main concern regarding energy price shocks is their impact on the competitiveness of energy-intensive industries. With the Iron and Steel and Chemical and Petrochemical industry as well as with Machinery this includes sectors of high importance for Ukraine's overall economy. Two common indicators of sectoral competitiveness are calculated in (Table 4). The first, Relative Trade Balance (RTB), gives the trade balance of a particular sector as percentage of total external trade of this sector. A positive value indicates a positive trade balance and the indicator increases with the size of the balance. The second indicator is a type of Revealed Comparative Advantage (RCA) which reports the ratio of exports over imports of a particular sector relative to the ratio of exports over imports of all sectors in the economy. A value of 1 indicates that this ratio in a given sector coincides with the relative trade structure of the overall economy while higher values indicate that the sector contributes more than average to total exports. Accordingly, benchmark index levels demonstrate the high importance of exports of energy - intensive industries as well as the significant negative trade balance of the energy sector due to large hydrocarbons imports.

Table 4
Sectoral Competitiveness Indicators

	Benchmark	Gas Price Shock	Gas and Electricity Price Shock	Price Shock and Energy Market Reforms	Previous Scenarios plus Increased Energy Efficiency
	-0-	-1-	-2-	-3-	-4-
Relative trade Balance (RTB)					
- Energy- Intensive Industry	0.23	-0.42	-0.52	-0.52	-0.34
- Agriculture and Construction	0.27	0.49	0.50	0.51	0.46
- Light Industry	0.15	0.70	0.74	0.64	0.54
- Energy Sector	-0.69	-0.71	-0.74	0.04	0.14
- Service Sector	0.14	0.33	0.37	0.32	0.29
Revealed Comparative Advantage (RCA)					
- Energy- Intensive Industry	1.41	0.35	0.26	0.26	0.40
- Agriculture and Construction	1.54	2.49	2.45	2.53	2.20
- Light Industry	1.19	4.95	5.35	3.73	2.71
- Energy Sector	0.16	0.15	0.12	0.88	1.07
- Service Sector	1.15	1.72	1.76	1.60	1.48

Source: German Advisory Group

As expected, energy price shocks – particularly for gas – will change this trade structure significantly. While energy-intensive industries loose in competitiveness, agriculture and in particular the light industry stand to gain. Moreover, reforms of the energy market (scenario 3) allow for higher exports of natural gas, which induces an almost even trade balance in the energy sector, while relative performance of other sectors remains as before. Finally, scenario 4 demonstrates how investments in more energy efficient technologies can compensate for some of the losses of energy-intensive industries. This suggests that despite worsening competitiveness of the average industry, efficient firms will still have opportunities to secure more favorable conditions. Nevertheless, our results underline that higher energy prices comprise a main challenge to energy-intensive industries In particular, the “standard” type of heavy industrial production in Ukraine, which has until recently benefited from rising global commodity prices, will significantly loose in national and international competitiveness. On the other hand, the results also underline the strong economic potential of agriculture and the light industry, which also includes a strong potential of small and medium - sized enterprises.

3.2.4 Natural Gas Sector

On a sector level some of the biggest changes are observed for natural gas production in Ukraine. Since the early 1990s domestic production has hardly exceeded 20 bcm per year. With official estimates of still more than 1,000 bcm of proven reserves this appears to be a rather low production level, in particular if compared with historical peaks of almost 70 bcm in the mid-1970s. While the decline in production since then mainly reflects the depletion in existing fields, investments in the development of new reserves can hardly be financed under the present system of export quotas and sale requirement of Ukrainian gas at low prices on domestic markets. With the increasing sense of political discomfort caused by the strong dependency on Russian imports, this is a particularly controversial constellation.

Table 5
Impact on Natural Gas Sector

	Benchmark	Gas Price Shock	Gas and Electricity Price Shock	Price Shock and Energy Market Reforms	Previous Scenarios plus Increased Energy Efficiency
	-0-	-1-	-2-	-3-	-4-
Natural Gas Sector (in bcm)					
- Domestic Production	20.5	32.3	32.8	57.5	57.9
- Exports	4.1	5.3	5.5	12.4	12.5
- Imports	62.2	13.3	10.3	10.0	9.5
Change in Lump-sum Transfers to households	-	-	-	23%	25%

Source: German Advisory Group

As our simulations reveal, the gas price shock will cause an increase in domestic production by about 10 bcm, mainly due to import substitution. This is far below the full economic potential of the sector as scenarios 3 and 4 demonstrate. Rather, once exports are no longer restrained by quotas and administrative cost control, domestic production and exports could expand dramatically. With annual production of 57-58 bcm (to be realized in about 10 years time) the currently known official reserves[11] would be exploited in about 20 years. While such an exploitation of finite resources is economically advisable as it secures present values[12], it is obvious that utilizing own hydrocarbons should be seen as a temporary measure to support the country's further development rather than a new pillar of a long -term energy strategy.

Regardless, however, of how long resources can actually be exploited, it is of particular importance to utilize newly created values in a socially balanced manner. Therefore, a key component of our simulations is the assumption that the government issues licenses for exploration of domestic gas fields which it sells in competitive auctions. Proceeds of these auctions are used to finance the public budget while any budget surplus is directly transferred to all private households in a "balanced" fashion where no one will be overcompensated as long as others still suffer economic losses Transfers can be interpreted as social payments such as public health provisions, pensions etc. They also comprise compensation payments to poor households for increased energy prices. Table 5 shows that a policy reform as simulated in scenario 3 allows the government to increase current transfers to private households by about 25% on average. This is one of the main drivers for the recovery of income losses of private households under scenarios 3 and 4 (see Table 1).

4 Conclusions, Policy Agenda and Further Analysis

We have argued that energy price shocks for gas and electricity will cause significant challenges to Ukraine's economy. However, our analysis also demonstrates that Ukraine's energy sector still restrains significant growth potential. Indeed, private investments and competition can reduce losses and increase productivity and, thus, stimulate energy efficiency. Moreover, Ukraine's natural gas deposits constitute a valuable asset that so far has not been used up to its full economic potential.

In model - based simulations we show how policy - induced productivity increases together with profit-maximizing use of natural gas reserves can significantly mitigate the negative consequences of energy price shocks. At the same time, a competitive energy sector emerges, which can serve as a backbone for sustainable future economic growth and development. In fact, our simulations have demonstrated that even if gas, electricity and heat prices all at least double, net economic losses of private households can be significantly reduced by means of suitable policy and investment responses. Moreover, under exogenous growth of only 2% per year on average over the next 10 years all net losses could already be fully compensate[13]. If however reforms and investments are further postponed and if the frequent political interventions in the energy are continued, policy makers will risk the basis for future growth because e.g. new businesses cannot be set up due to disruptions in energy supply. Hence, the main conclusion of our analysis is that a suitable long –term policy strategy based on free market competition and liberalization as well as on social transfers needs to be developed and implemented. How could this be achieved?

A necessary step is the regional integration of Ukraine's energy sector. The EU-Ukrainian Memorandum of Understanding on adjustment towards the EU energy directives as well as Ukraine's accession as an observer to the Energy Community Treaty are excellent starting points. However, the expression of such intentions needs to be followed by subsequent measures. Here, much remains to be done, e.g. with respect to approving necessary legislation on transparently regulated Third Party Access to networks, the unbundling of vertically integrated companies, market opening to new entrants and independent price regulation. We have already presented a detailed agenda on what remains to be done in a previous policy paper[14].

[11] This refers to official government estimates of 1030 bcm as revealed in Ukraine's Energy Strategy to 2030, excluding unconventional hydrocarbons such as Methane.
[12] Especially in the current situation where global energy prices are rather high and are – if anything – expected to slightly decrease over a medium-term period.
[13] This result has been derived from an additional scenario which we have not further discussed in the paper due to limitations in space and time.
[14] Advisory Paper V8: EU Energy Sector Reforms: A benchmark for Ukraine! GAG (2006).

For the Wholesale Electricity Market a sufficient reform proposal has in principle been developed. The main provision is a regime shift from the current Power Pool to a system of bilateral contracts which has strong potential to further stimulate competition and development in the sector. Furthermore, competition should cover all electricity generators, including nuclear and hydro power. However, while this program has been adopted as early as 2002 the implementation process since then has been rather slow. A stronger commitment of the government to fine-tune and eventually implement the new regime is strongly recommended.

Moreover, a number of policy fields require additional efforts by decision makers. These include:

- Strengthening the independency of the NERC as the regulatory agency in the sector. Until today, the commission lacks its legal foundation and operates only on the basis of a presidential decree.
- Further competitive and transparent privatizations of energy assets to different investors are a necessary condition for competition to emerge. Experiences from all over the world also demonstrate that private ownership stimulates efficiency and productivity of energy companies.
- Trade in Emissions Certificates under the Kyoto Protocol is a strongly emerging opportunity for energy companies with particularly huge potentials in the EU. Ukraine has one of the highest technical potential to benefit from new opportunities and could secure significant co-financing for energy efficiency investments. However, the necessary legal and institutional requirements have so far not been met.

Finally, the new energy policy must be supported by additional measures such as reforms of the communal enterprise sector, main customers of energy companies, with a special focus on regulation and the creation of level playing fields[15].

In political reality, the implementation of necessary reforms also suffers a lot from populistic opposition stimulated by the fear of rising domestic energy prices. Such arguments are difficult to contradict, given the apparent lack of (quantitative) understanding of the economic effects and impacts of current and future energy price shocks and the extent to which market reforms are capable to overcome negative consequences. Hence, what is needed is more empirical work along the lines of the present study. Based on the insights developed so far the following issues require deeper and more empirical understanding:

- The impact of different types of fuels and technologies on electricity generation, investments in transmission and distribution networks under consideration of physical and commercial constraints, as well as the potential of CHPs on heat and power sectors require further specific analysis, ideally within a separate modeling framework;
- Similarly, physical and commercial constraints in the gas sector as well as its economy-wide importance and how to best utilize it also require further analysis. This should also include different proposals of licensing schemes and types of auctions;
- Energy - saving investments in the residential sector promise significant benefits which have so far not been accounted for;
- The potential of selling Emission Certificates in the frame of JI projects for financing new investments needs to be assessed;
- Finally, more reliable estimates on the impact of energy price shocks on the competitiveness of specific industries and companies require more specific modeling efforts.

Author: FP

Lector: VM

Kiev, May 2007

[15] We have already presented several Policy Papers on this issue, e.g. U12: Regulatory scheme for utilities: proposal for Ukraine (GAG 2005).

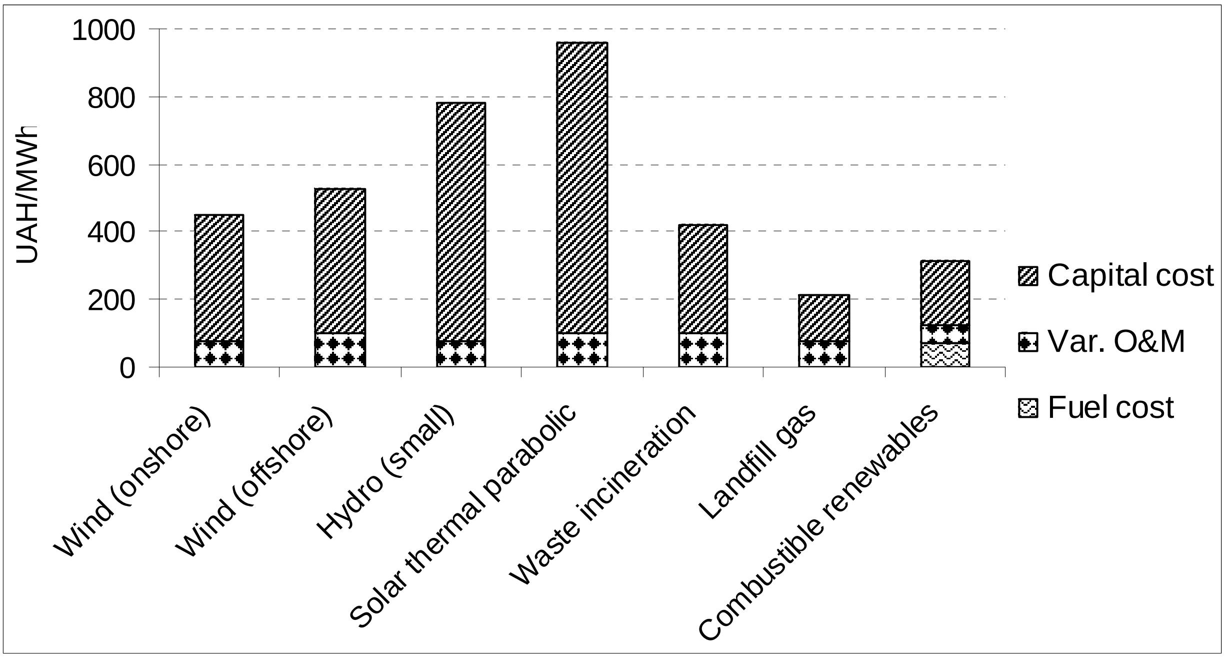
Appendix

Table A1
Impact on Electricity Sector

	Benchmark	Gas Price Shock	Gas and Electricity Price Shock	Price Shock and Energy Market Reforms	Previous Scenarios plus Increased Energy Efficiency
	-0-	-1-	-2-	-3-	-4-
Electricity Generation (in GWh)	182,056	99,583	86,334	108,524	101,178
In % by Type of Fuel					
- Gas	0.08	0.06	0.03	0.03	0.03
-Gas (CHP)	0.14	0.00			
- Coal	0.25	0.29	0.16	0.16	0.16
- Coal (CHP)			0.25	0.20	0.22
- Nuclear	0.45	0.52	0.41	0.48	0.46
- Hydro, other	0.07	0.14	0.16	0.12	0.13

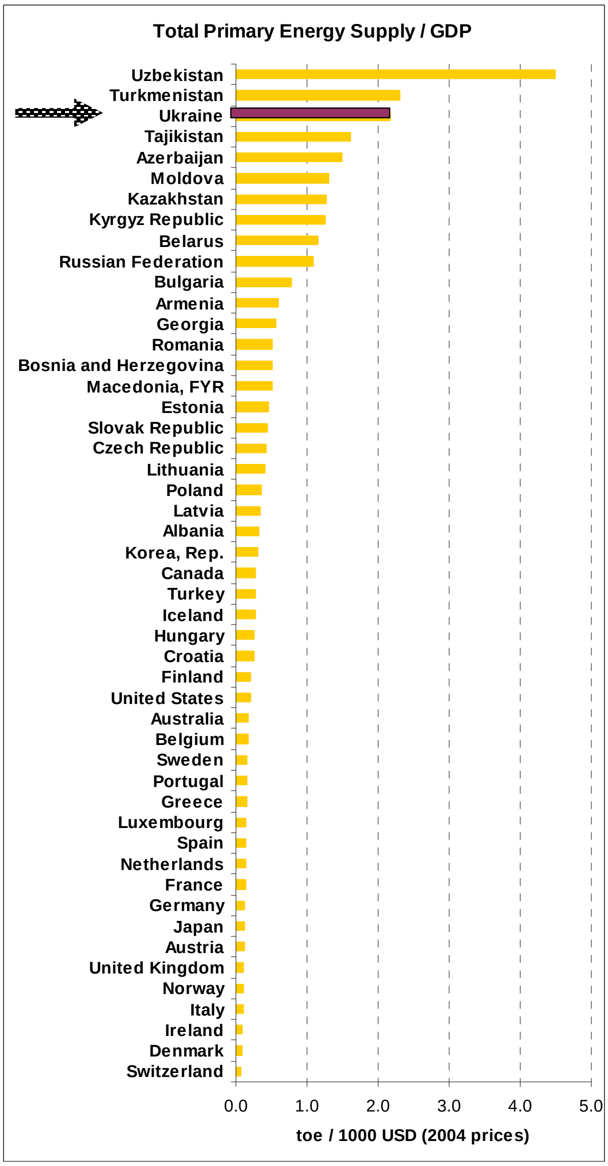
Source: German Advisory Group

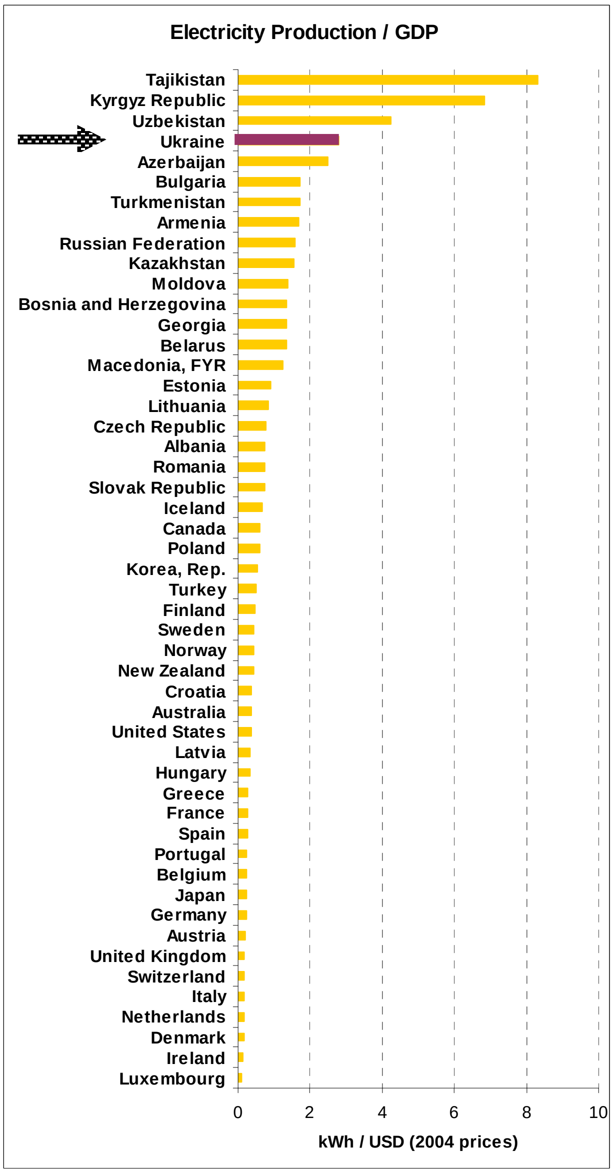
Picture A1
Long-run Marginal Costs of Electricity Generation (renewable fuels)



Source: OECD, own calculations.

Picture A2
Energy Efficiency by Selected Countries





Source: World Bank Global Development Indicators (all 2004)