

# Electricity privatisation and restructuring in Russia and Ukraine

by

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## 1. The Russian Electricity system

### 1.1. Supply and demand

The Russian Federation covers a vast land mass, nearly double the size of the United States, including eleven time zones and has a population of nearly 150 million people. However, much of the land is sparsely populated and the interconnected system is nearly all to the West of the Urals. The total installed electricity generating capacity in 2003 was 216GW, of which 69% was fossil-fuel fired (coal, oil or gas), 21% was hydropower and 10% was nuclear. In terms of generation, oil, gas and coal account for roughly 63% of Russia's electricity generation, followed by hydropower (21%) and nuclear (16%), reflecting the higher utilisation rates for nuclear plants than for fossil fuel plants. Amongst the fossil fuels, natural gas is the main generating fuel accounting for about two thirds of fossil fuel generation. Generation from other sources, e.g., renewables (excluding hydro) is negligible.

Electricity demand has been growing at about 2% per year since 1999 but is still about 10% below the demand levels of 1992. In 2001, about 17% of electricity consumption was in the energy sector (oil, gas and coal). Of the energy supplied to final consumers, 52% was in the industrial sector, 23% was in the residential sector, with the rest split between commerce and public services (11%), transport (10%) and agriculture (4%). In part reflecting the size of the territory, distribution losses were high, representing 12% of domestic supply.

Table 1 shows that production grew rapidly in the 1970s, more than 5% per year, but less rapidly in the 1980s. From 1990 to 1998, production fell (by nearly a quarter) and by 2002 was still 18% below 1990 levels. Nuclear power's contribution has increased from a very low level in 1970 to 7% in 1980, 11% in 1990 and 16% in 2002, at the expense of thermal power.

**Table 1. Electricity production and installed capacity**

	1970	1980	1990	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Growth rate (%) 1980 To 2002
Electricity production (TWh)														
- Total	470	805	1082	957	876	860	847	834	827	846	862	886	892	0.5
- Thermal	373	622	797	663	601	583	583	567	564	563	568.5	576	578	-0.3
- Hydro	94	129	167	175	177	177	155	158	159	161	165.4	175	175	1.4
- Nuclear	4	54	118	119	98	100	109	109	104	122	129	135	140	4.3
Capacity of electrical plants (GW(e))														
- Total	105.1	165.4	213.3	213.4	214.9	215.0	214.5	214.2	214.1	214.3	204.5	214.9	214.9	1.2
- Thermal	81.3	121.1	149.7	148.8	149.7	149.7	149.2	149.0	148.7	148.3	138.9	148.5	148.5	1.0
- Hydro	23.0	35.1	43.4	43.4	44.0	44.0	44.0	43.9	44.1	44.3	44.4	44.2	44.2	1.1
- Nuclear	0.8	9.2	20.2	21.2	21.2	21.3	21.3	21.3	21.3	21.7	21.2	22.2	22.2	4.0

### 1.2. The Networks

The Russian electricity system comprises a number of networks. Most of the power is in the West comprising about 95% of generating capacity. This is divided into 6 interconnected power pools:

- Central Power Pool (29.8 % of total capacity);
- Siberia Power Pool (29 % of total capacity).
- Ural Power Pool (16.5 % of total capacity);
- Middle Volga Power Pool (10.3 % of total capacity);
- North Caucasus Power Pool (5.5 % of total capacity);
- Northwest Power Pool (4.4 % of total capacity).

The Regional Electricity System "VOSTOK" operates separately from the main grid. It covers the far eastern part of Russia and consists of four Local Electricity Systems generating 41.0 TWh or 4.4% of total electricity generation in 2000. There is a limited amount energy exchange between the two main country systems.

There are five Isolated Local Electricity Systems, which are rather small and situated in remote regions where communication with the rest of the country is difficult. Despite their small size, they are clearly very important locally. In 2000, these systems generated 1.2 TWh or 0.1% of total electricity generation.

### 1.3. RAO/UESR

The industry structure is in transition following the announcement of structural reforms in 2003. The dominant company at present is RAO "UES (Unified Energy Systems) of Russia" or RAO UESR, which is, at present is 52.7% owned by the Russian Federation. As at December 31, 2003, the company had 352,074 shareholders, with 43.9% held by legal persons and nominees and the rest by private individuals.<sup>1</sup> The first shares in RAO UESR were issued in 1993 with a major issue in 1995.

The Holding Company of RAO UESR is one of the three largest companies in Russia and is the largest employer in Russia with 577,600 employees in 2003. It owns 72.4% of the generating capacity and 96.1% of the total length of transmission lines (over 3 million kms of lines). RAO UESR oversees and has shares in the 73 regional electricity companies, known as 'energos' (see Table 2). These companies generate electricity, operate the regional distribution networks and supply to final consumers. Table 3 shows the output of the ten largest generating Energos, which account for about 44% of RAO UESR's production. Federal thermal plants account for a further 16% of generation and federal hydro plants for 10%. Energos supplied about 60% of electricity sold in Russia. In 2003, RAO UESR employed an average of 577,600 people compared to 632,000 in 2002 and 665,000 in 2001.

**Table 2. RAO UESR ownership of energos**

% ownership	Number
100	9
76-100	1
51-75	9
26-50	52
0-25	2

Source: <http://www.rao-ees.ru/en/business/report2003/>

**Table 3. Output of the ten largest Energos, RAO UESR Federal Plants and Nuclear (2003)**

	Output (TWh)
Mosenergo	75127
Tyumenenergo	68315
Sverdlovennergo	38886
Kuzbassenergo	24878
Samaraenergo	14007
Orenburgenergo	13865
Novosibirskenergo	12252
Lenenergo	12421
Chelyabenergo	8900
Khabarovskenergo	8160
<b>Total large energos</b>	<b>276811</b>
<b>Federal thermal plants</b>	<b>103070</b>
<b>Federal hydro plants</b>	<b>63147</b>
<b>Total RAO UESR production</b>	<b>635800</b>
<b>Rosenergoatom</b>	<b>148618</b>
<b>Total Russia production</b>	<b>916100</b>

Source: <http://www.rao-ees.ru/en/business/report2003/> and <http://eng.rosatom.ru/>

<sup>1</sup> Apart from the State, the major shareholders were Non-profit Partnership "National Depository Center" (as nominee) (14.0%), OAO "Savings Bank of the Russian Federation" ("Sberbank") (as nominee) (10.5%), ZAO "Depository Clearing Company" (as nominee) (7.2%) and ING BANK (EURASIA) ZAO (as nominee) (6.6%).

#### 1.4. The nuclear sector

Russia's 10 nuclear power stations are owned by Rosenergoatom, which is fully federally owned. It was set up in 1992 to own and operate 9 out of 10 of Russia's nuclear power plants, excluding the Leningrad plant (which was an important export earner selling power to Finland). In 2002, the company was reformed and the Leningrad plant was brought into Rosenergoatom as well as the plants under construction. It has a total operating capacity of about 21600MW of operating plants (30 units) with two units (each 1000MW) under construction

Of the 10 sites, one, Bilibino, is sited in the far North East and is very small (44MW) supplying electricity and heat to mining industries and another, Beloyarsk is the site of a prototype fast breeder reactor. The other 8 stations are all commercial facilities each with at least 1000MW of installed capacity in operation. About half the operating capacity is of the WWER design, comparable to the Western Pressurised Water Reactor (PWR), the most common design in the West. The other plants are of the RBMK design, the type used at the Chernobyl site. Plans to expand nuclear power have been severely scaled back after 1992 and only two units (one RBMK) are now under construction, both for 20 years or more.

#### 1.5. International trade

Stagnant demand for power in Russia has allowed RAO UESR to develop a lucrative export market for power, both to the CIS countries and to Western Europe (see Table 4). In 2003, RAO UESR (with 60% of the shares) and Rosenergoatom (40%) formed a new company, ZAO "Inter RAO UES" to trade in power and in 2003 it exported 20.7TWh of power with revenue of US\$485.3m. About 54% of the exports were to the Nordic market with the next largest customer Belarus accounting for about 17% of sales. A number of Russia's former partners, such as Poland, Czech Republic, Slovak Republic, Hungary, Bulgaria and Romania have synchronised their electricity networks with those of the Western European network (UCTE) severing their ties with Russia and restricting trading opportunities for Russia. There is now an agreement between Russia and Europe to synchronise the Russian electricity grid to that of Western Europe and this will improve further prospects for exports of Russian power.

**Table 4. Exports of power from Russia by ZAO**

	Net exports (GWh)
<b>CIS Countries</b>	
Belarus	3532
Georgia	866
Kazakhstan	1793
Moldova	879
Ukraine	214
<b>Europe</b>	
Latvia	761
Finland	10993
Norway	182
<b>China</b>	<b>162</b>
<b>TOTAL</b>	<b>20700</b>

Source: <http://www.rao-ees.ru/en/business/report2003/>

Note: Exports to Azerbaijan were routed through Georgia.

#### 1.6. Foreign investment

So far, foreign investment in the Russian electricity industry has been negligible and with the collapse of the international activities of Western electric utilities, there seems little prospect that foreign investment will play a significant role at least for the next few years.

One of the few foreign investors is Fortum, which in 2004, took a 30% share in Lenenergo (RAO UESR owns 49%). Given that the power exported to Finland from Russia is from this region, the motivation for Fortum is clear.

ENEL has signalled its intention to bid for assets in Russia as they become available and was a member of a consortium given a contract in 2004 to manage a Russian power plant an 1800MW thermal power plant (North West), the first foreign company to win such a role

### 1.7. Reforms

A major restructuring of the Russian electricity industry began in 2003, expected to be complete by 2008. By then, it is projected that the structure of the industry will mirror that being imposed in Western Europe on its Member States by the European Union. This would require full corporate separation of monopoly network activities (the national high-voltage transmission network and the local and regional distribution networks) from electricity generation and retail supply to final consumers. The retail and generation businesses would become competitive with prices set by the market, while the network businesses would remain regulated monopolies.

For the generation business, a competitive Wholesale Electricity Market comprising the European part of Russia, the Urals and Siberia (except for the isolated energy systems) would be created, while in the retail business, all consumers would be allowed to choose their retail supplier.

#### 1.7.1. Structure

The structure that the reforms would attempt to create would be as follows:

- **Infrastructure companies.** A Federal Grid Company would be created which would manage the Unified National Power Grid (UNPG). The System Operator, OAO "UES SO-CDA" would control the operational dispatch of the system, with powers to command generators;
- **Generation companies.** Ten Wholesale Generating Companies (WGCs), would be spun off from RAO UESR and the Energos, six with thermal power plants and four with hydro plants. An unspecified number of Territorial Generating Companies would be created from the assets of the Energos;
- **Retail companies.** Competitive Retail Companies will be established on the basis of retail units spun off in the course of regional Energos' restructuring. A number of Guarantee Suppliers would be created who would have an obligation to ensure uninterrupted supply of electricity to customers in the event of a competitive supplier.

#### 1.7.2. Timetable

Reforms would take place in three phases: 2003 – early 2005; 2005-2006; and 2006-2008:

- **2003 – early 2005.** In this phase, a competitive element of the wholesale market would be launched, establishment of the WGCs would begin with some being divested from RAO UESR, Energos would begin to be split into separate businesses and interregional transmission companies (ITCs) would be established with the transfer of transmission assets owned by the Energos to the ITCs;
- **2005-2006.** In this phase, the competitive segment of wholesale electricity market would be expanded, territorial generation companies (TGCs) and interregional distribution companies (IDCs) would be established and establishment of WGCs would be completed;
- **2006-2008.** In the final phase, operation of liberalised wholesale and retail markets would start and there would be an increase in the state's interest in the organization managing the Unified National Power Grid and the System Operator, but a reduction of the state's interest in WGCs and TGCs, where necessary.

#### 1.7.3. Progress

A number of Energos have now completed restructuring and in mid-January 2005, 21 companies had restructured, generally into a generation company, a transmission company (generally known as an Energy Management Company) and a retail company. Work is underway to transfer to OAO "UES FGC" the property included in the Unified National Power Grid (UNPG). The setting up of the 10 WGCs has started with RAO UESR remaining the sole shareholder initially. Territorial Generation Companies and Interregional Distribution Companies are also in process of being set up.

The basic mechanism for the separation of companies from RAO UESR will be spin-off involving pro-rata distribution of shares. This mechanism entitles each shareholder in RAO UESR to a proportional interest in the newly established companies.

Ultimate privatisation of the assets has long been planned but plans to sell off shares have continually been postponed. However, Gazprom has been active buying shares in the electrical sector taking 10.6% of RAO UESR and 25.01% of Mosenergo.

The competitive market segment within the Federal Wholesale Electricity (Capacity) Market (FOREM) was launched on 1 November 2003 in the European part of Russia and Urals. Under the Rules of the Wholesale Electricity Market of the Transitional Period, energy providers may sell in the competitive market segment electricity generated with equipment making up to 15% of their working capacity. Buyers are able to purchase up to 30% of their planned energy consumption. Equilibrium nodal prices are set for each hour of the following day.

The sellers were Rosenergoatom, 23 thermal power plants and 12 hydroelectric plants. The buyers were 68 Energos, and 40 large consumers and electricity suppliers. As a result of this opening up, regulated electricity supply by Energos fell by 9% compared to 2002 as a result of several large industrial consumers entering the FOREM.

**Table 5. Restructuring of Energos**

<b>OAo Astrakhanenergo</b>	OAo Astrakhan Regional Generation Company OAo Astrakhan Energy Management Company OAo Astrakhan Energy Retail Company
<b>OAo Lipetskenenergo</b>	OAo Lipetsk Generation Company OAo Lipetsk Energy Management Company OAo Lipetsk Energy Retail Company
<b>OAo Rostovenergo</b>	OAo Rostov Generation Company OAo Rostovenergo Management Company OAo Energosbyt Rostovenergo
<b>OAo Ryazanenergo</b>	OAo Ryazan Heating Company OAo Ryazan Management Company OAo Ryazan Energy Retail Company
<b>OAo Tambovenergo</b>	OAo Tambov Generation Company OAo Tambov Energy Management Company OAo Tambov Energy Retail Company
<b>OAo Tverenergo</b>	OAo Tver Generation Company OAo Tver Management Energy Company OAo Tver Energy Retail Company OAo Tver Energy Repair Company
<b>OAo Yarenergo</b>	OAo Yaroslavl Energy Company OAo Yaroslavl Management Energy Company OAo Yaroslavl Retail Company
<b>OAo Vladimirenergo</b>	OAo Vladimir Generation Company OAo Vladimir Energy Retail Company
<b>OAo Volgogradenergo</b>	OAo Volzhskaya Generation Company OAo Volga-Don Energy Complex Management Company OAo Volgogradenergobyt
<b>OAo Ivenergo</b>	OAo Ivanovo Generation Company OAo Ivanovo Energy Retail Company
<b>OAo Karelenenergo</b>	OAo Karelenenergogeneratsiya OAo Karelenenergo Management Company OAo Karelia Energy Retail Company
<b>OAo Kostromaenergo</b>	OAo Kostroma Generation Company OAo Kostroma Retail Company
<b>OAo Marienergo</b>	OAo Mari Regional Generation Company OAo Mari Regional Management Company OAo Marienergobyt
<b>OAo Penzaenergo</b>	OAo Penza Generation Company OAo Penza Energy Management Company

	OAO Penza Energy Retail Company OAO Penza Energy Repair Company
<b>OAO Udmurtenergo</b>	OAO Udmurt Territorial Generation Company OAO Udmurt Management Energy Company OAO Udmurt Energy Retail Company
<b>OAO Chuvashenergo</b>	OAO Chuvash Generation Company OAO Chuvash Management Company OAO Chuvash Energy Retail Company
<b>OAO Bryanskenergo</b>	OAO Cheboksarskaya HPP OAO Bryansk Energy Management Company OAO Bryansk Retail Company
<b>OAO Belgorodenergo</b>	OAO Bryansk Generation Company OAO Belgorod Retail Company OAO Belgorod Heat Energy Company

#### 1.7.4. Re-organisation of Energos

By January 11 2005, 21 regional energos had largely completed separation by lines of business. No details have been published for three of these, Pskovenergo, Kalugenergo and Voronezhenergo. The businesses for which split-up details have been published are shown in Table 5.

#### 1.8. New investments

For the future, RAO UESR is looking to reduce the investment burden on its own resources by wider use of borrowed funds, and use of external investors. The investment programme for 2004 (see Table 6) called for investment of RUB93.5bn (about US\$3.4bn) and was primarily directed at thermal and hydro electric power plants with completion of 1258MW of new plants projected.

**Table 6. Investment Program of RAO UESR Holding Company for 2004**

	Investments, RUB billion*
Total for RAO UESR Holding Company	93.5
including	
AO-power plants	9.5
Regional Energos	54.8
RAO UESR	15.1
OAO UES FGC	13.4
OAO UES SO-CDA	0.7

\* Without taking into account borrowed funds.

#### 1.9. International activities of RAO UESR

RAO UESR has been a bidder in a number of privatisations in the past year:

- In January 2005, it was one of 12 companies bidding to buy three power plants in Bulgaria and it also bid unsuccessfully for a stake in the Bulgarian grid;
- It was an unsuccessful bidder for a two thirds stake in the Slovak electric utility, Slovenske Elektrarne (SE) – ENEL of Italy was the successful bidder;
- RAO UESR has been discussing with the Moldovan and Georgian governments the possibility of investing in those countries; and
- RAO UESR plans to bid for stakes in Ukrainian distribution companies

Before 2004, it had acquired assets in Georgia (power plants sold by AES of USA), Armenia (shares in 5 hydro stations and ownership for five years of the nuclear power station) and Kazakhstan.

### 1.10. Relations with the European Commission

The European Union has for some years been trying to establish relations with Russia, but with little concrete success. Negotiations on a European Energy Charter were begun in 1990. Broadly, the Charter was intended to smooth investment by Western countries in Russia, in return for access to Russian fossil fuels. Use of Western money to improve the safety of Russian designed reactors was also an important element. However, progress on this was slow and has stalled for the last 10 years. A Partnership and Cooperation Agreement (PCA) signed by Russia and the EU (in force since 1997) was a forum to set up cooperation in areas of common interest and resulted in the launch of an 'energy dialogue' in 2000.

Factors behind this dialogue included the decision by Russia to join the WTO and the joining of the EU by eight countries from central and eastern Europe. It is difficult to identify precise results, but the Commission claims that difficulties for Russian companies investing in the EU (e.g. Gazprom) and difficulties for EU companies investing in Russia have been smoothed (e.g., BP Shell etc).

The Commission claims as specific benefits:

- The ability to sign long-term contracts for gas and the removal of restrictions on imports of hydrocarbons from Russia to EU countries;
- The signing by Russia of the Kyoto Protocol;
- The launching of energy efficiency projects;
- Easier trade in energy products;
- The proposed connection (synchronisation) of the Russian electricity network with that of Western Europe

How significant these achievements are and how far they can be attributed to the PCA is hard to determine. However, most of the achievements are relevant to hydrocarbons rather than the electricity sector, although the proposed reforms of the Russian electricity industry will largely bring it in line with the requirements of the Commission's Electricity Directive (EC/2003/54/EC). The synchronisation of the Russian grid with that of most of Western Europe (the UCTE system) is the subject of a joint study by the EU and Russia. The study is expected to report in 2006, although there is a possibility the timetable will be brought forward by a year.

### 1.11. Politics of reform

There has been recent opposition in Russia to some liberalization reforms, such as the demonstrations by pensioners against the replacement of benefits in kind (such as energy) with less valuable cash payments. On the other hand there is very strong international pressure for the liberalisation of the electricity sector. It is seen as an extremely large investment opportunity for foreign companies and banks, and so potential foreign investors are supportive of the reform programme and concerned at signs that it may slow down.

The president of the EBRD, M. Lemierre, said in January 2005 that Russia "could send positive signals to investors" by resuming the restructuring of RAO UESR, which was suspended in summer 2004.

### 1.12. Policy issues for the Russian electricity sector

There would appear to be three main priority issues for the Russian electricity sector for the next few years: the fate of the nuclear sector; foreign investment in the electricity sector; and the proposed entry to the European Union.

#### 1.12.1. The nuclear sector

Russia has eight main civil nuclear power stations (excluding prototype or small units) comprising 25 units at Balakovo (4 units), Kalinin (2 units), Kola (4 units), Kursk (4 units), Leningrad (4 units) Novovoronezh (3 units), Smolensk (3 units) and Rostov (1 unit). There are units reported to be under construction at Rostov, Kursk and Kalinin. Of the operating units, 8 (those at Balakovo, Kalinin, Rostov and one at Novovoronezh) are of the VVER-1000 design and 4 units of the VVER-440/213 design (those at Kola). These designs are not regarded by the West as priorities for early closure. There are two first generation VVER-440 units (at Novovoronezh) and 11 units of the RBMK design (Leningrad, Kursk and Smolensk). There are two VVER-1000 units under construction (Rostov and Kalinin) and one RBMK (Kursk).

Russia has resisted pressure to close the plants characterized as being 'unsafe', indeed, it has refurbished the Leningrad RBMK station with the expectation that it will be able to run for at least another decade. Russia has generally not opened its plants to international quality inspections and it has not been amenable to pressure from the West to close plants the West regards as unsafe. The Russian nuclear industry is still very active building plants in China, India, Iran, Ukraine as well as Russia. These comprise half the world capacity of nuclear plants under construction. There are also part-built units in Cuba, Libya, Ukraine, Slovak Republic and Bulgaria that are not currently active.

Closer ties with the European Union are likely to bring pressure to close the 'unsafe' plants, representing more than half of Russia's nuclear capacity.

#### 1.12.2. Foreign investment

There has so far been minimal foreign investment in the Russian electricity sector. The scale of the market and the natural resources that Russia possesses, especially the natural gas would make Russia an attractive place to invest in some respects, but Russia would still be regarded as a high risk place to invest and it seems unlikely that much of Russia's investment needs in the electricity sector would be met by foreign capital.

#### 1.12.3. Proposed entry to the European Union

Russia has begun a programme of radical restructuring of the electricity sector, breaking up the oblenegos into network, retail and generation companies and creating at least 10 Wholesale Generating Companies and a number of Regional Generating Companies. Retail competition would be introduced for all consumers, currently planned for 2006-8 and a wholesale market established. This would bring Russia into line, at least in principle, with the EU Electricity Directive. However, it remains to be seen whether such a large number of new companies can be established and whether the logistical steps for retail competition can be carried out in time.

However, the more important issue is whether the model underlying the Directive is suitable for Russia. There are concerns on at least four grounds;

- **Retail competition.** Retail competition has proved expensive to introduce, for example, cost UK small consumers about £300m per year (more than £10 per consumer) and has resulting in a significant widening of the price differential between large consumers and residential consumers resulting from the much stronger negotiating power of large consumers;
- **Wholesale competition.** Most wholesale markets in Europe have minimal liquidity and the published prices have little value as market signals. Most power is bought and sold on long-term contracts or is bought by integrated generation retail companies generating for their own consumers, thereby bypassing the visible wholesale market;
- **Oligopolies.** Most countries have seen little real competition with the markets dominated usually by a monopoly or duopoly. National governments appear to prefer to allow strong home companies to have a strong national base with little competition to allow them to expand into foreign markets;
- **Reliability.** Most countries that have liberalised their electricity industry have seen large reductions in the workforce. This and the lack of control of how much generating capacity there is has led to concern that liberalisation will lead to a poorer standard of supply security if networks are not properly maintained and there is insufficient generating capacity.

## 2. The Ukrainian electricity system

### 2.1. Supply and demand

Table 7 shows that electricity demand in the Ukraine more than doubled in the 1960s and grew by 5% a year during the 1970s, but only grew by less than 2.5% a year in the 1980s. Since 1990, demand declined sharply and in 2001 was 43% lower than in 1990. In 2001, thermal power production was only 40% of the level of 1990 with substantial implications for coal demand, especially from Ukrainian mines.

Ukrainian nuclear power plants generated 87TWh of electrical energy in 2004, 6.9 percent more than in 2003. The share of nuclear power facilities in Ukraine's total electrical energy output was 48%.

**Table 7. Electricity production and installed capacity**

	1960	1970	1980	1990	1994	1995	1996	1997	1998	1999	2000	2001
Electricity production (TWh)												
- Total	53.9	137.6	236.0	298.5	202.9	194.0	183.0	178.0	172.8	172.1	171.4	173.0
- Thermal	49.9	126.0	208.4	211.7	120.5	113.4	94.6	88.6	81.7	81.7	82.6	84.6
- Hydro	4.0	11.6	13.4	10.7	12.3	10.1	8.8	10.0	15.9	14.5	11.5	12.2
- Nuclear	0.0	0.0	14.2	76.1	68.85	70.5	79.6	79.4	75.2	75.9	77.3	76.2
- Imports	N/A	N/A	-17.5	-28.5	-1.0	-3.0	-2.0	-0.2	-0.7	-3.4	-3.8	-3.1
- Gross Domestic Consumption	N/A	N/A	218.5	270	201.9	191.0	181.0	177.8	172.1	168.7	167.6	169.9
- Distribution Losses	N/A	N/A	19.2	21.9	21.7	18.8	25.0	28.4	30	30.2	31.2	34.1
- Final Consumption	N/A	N/A	199.3	248.1	180.2	172.2	156.0	149.4	142.1	138.5	136.4	135.8
Capacity of electrical plants (GW(e))												
- Total	11.7	27.9	43.9	55.6	55.2	53.9	54.0	53.9	53.8	53.9	53.8	52.8
- Thermal	9.9	25.4	37.4	37.1	37.7	35.4	35.7	36.5	36.3	36.4	36.3	36.3
- Hydro	1.8	2.5	4.0	4.71	4.70	4.70	4.70	4.70	4.70	4.70	4.7	4.7
- Nuclear	0.0	0.0	2.44	13.8	12.8	13.8	13.6	12.7	12.8	12.8	12.8	11.8

After the break up of the Soviet Union, the Ukrainian electricity sector experienced severe problems for the next 6 years, for three main reasons. First, the Ukrainian economy suffered severe recession with recorded GDP falling to less than 40% of the level of 1990; second, the 1986 Chernobyl disaster was a major limitation on policy; and third, various attempts at reforms and restructuring of the electricity sector proved unsuccessful.

### 2.2. Economic decline

The decline in GDP<sup>2</sup> led to a sharp reduction in demand for electricity and also affected the ability of consumers to pay for their power. Demand for electricity fell by about a third in that period and by 1998, only about 10% of electricity consumption was paid for with cash. Most was paid for by barter and more than 10% was not paid for at all.<sup>3</sup> This led to a chronic cash shortage for the industry and despite having an installed capacity equal to about double peak demand, electricity supplies became unreliable because there was not enough money to buy the fuel and the plant spares necessary to run the plants, especially the fossil fuel-fired plants. As a result, interconnections with other countries, especially Russia, were broken and the Ukrainian system ran as an island for long periods, further reducing the reliability and the stability of supplies.

However, from 1999 onwards, the Ukrainian economy has grown at a very rapid rate. Annual growth rates in the years 2000-2003 was 6%, 9%, 4.1% and 8.2%<sup>4</sup> and 2004 figures are expected to show growth of 12%. While this has led to GDP nearly doubling in only 5 years, it leaves output at only about 60% of 1992 levels.

<sup>2</sup> Measurement of GDP became very difficult in the 1990s because of the increasing part played by unrecorded activities so the official figures for GDP are likely to overstate the extent of the economic decline

<sup>3</sup> <http://www.antenna.nl/wise/index.html?http://www.antenna.nl/wise/507/4991.html>

<sup>4</sup> Financial Times, January 7, p 38.

Electricity demand has not rebounded so strongly, probably because the old electricity intensive industries that closed after 1990 have been replaced by much less electric-intensive activities.

### 2.3. The Chernobyl disaster

The Chernobyl disaster left Ukraine with serious clean-up problem and from 1995 onwards, there has been uncertainty about how the West would help Ukraine deal with the problem. The Chernobyl plant comprised four 1000MW units. One was destroyed in the accident and a second unit was near the end of its operating life and was closed in 1996. The other two units were closed in 1999 and 2000. An agreement between Ukraine and the G7 seemed to provide for Western funding (through the European Bank for Reconstruction and Development, EBRD) to complete two part-built Russian designed plants (of a different technology), Khmel'nitski 2 and Rovno 4 (often termed K2/R4), but this was not forthcoming and the units were completed in 2004 using other funds. The EBRD is however funding safety upgrades which it is hoped will bring the plants up to a better level of safety.

### 2.4. Industry structure

The dramatic decline in electricity demand has left nuclear power as the dominant source of electricity in Ukraine. In 1992, it accounted for less than a third of electricity generation with most of the rest thermal power (gas and coal) and hydro less than 10%. However, one new 1000MW unit was completed in 1995 and as demand has fallen, the sources with the lowest marginal costs have been retained (hydro and nuclear) and in 2003, 45% of electricity was nuclear, about 10% hydro and the rest thermal. The completion of two more nuclear units in 2004 is likely to mean that more than half of Ukraine's electricity generation will be nuclear. Total installed capacity is about 55GW but in 2003, these plants only generated 167TWh, a utilization rate of only about a third.

Various programmes of restructuring have been attempted but there has been little interest by Western companies and much of the sector remains in public hands. In June 2004, the Ukraine government consolidated its holdings in energy companies in a new company, Energeticheskaya (Energy) Company (EKU).

#### 2.4.1. Generators

The most important generating company is the state-owned Energoatom, which owns nearly 15GW of nuclear plants contributing about half of Ukraine's electricity (see Table 8). Three further units each of 1000MW are reported to be under construction, although it is far from clear whether these will be completed.

**Table 8. Electricity generation companies in Ukraine**

	% State-ownership via EKU	Capacity (GW)
Energoatom	100	15
Donbassenergo	86	n.a.
Zakhidenergo	70	4.7
Tsentrenergo	78	7.6
Dniprenergo	76	8.2
Ukrhydroenergo	100	4.6
Kievenergo	50	1.2

Note: EKU ownership was as at the time of its establishment in June 2004. Energoatom is owned directly by the State

The thermal plants are owned mainly by four generating companies, Donbassenergo, Zakhidenergo, Tsentrenergo, and Dniproenergo, with a total capacity of about 36GW. A number of attempts have been made to sell these companies, but the State still has majority shares in all of them.

Donbassenergo was the largest of these until 2001, when three out of its five power stations were sold to unidentified owners to clear debts, but the government still owns 85.8% of the shares of the remainder of the company. Zakhidenergo owns 4.7GW of plant and is 70.1% owned by the State, Tsentrenergo owns 7.6GW of plant and is 78% owned by the State and Dniproenergo owns 8.2GW of plant and is 92% State-owned.

Until 2004, the hydro capacity was owned by two State-owned companies, Dniprohydroenergo and Dniesterhydroenergo, but these were merged to form Ukrhydroenergo with a total capacity of 4.6GW.

Another important company is Kievenoenergo, which generates all the power and supplies all the heat to Kiev and employs 18,000 people. The state owns 50% + 1 of the shares, with 12.7% of the shares owned by the municipal authorities, the rest being held mainly by small investors. It owns 1200MW of generating plant and operates over 4000km of heat pipelines.

#### 2.4.2. Distribution companies

There are 27 distribution companies, or ‘oblenergos’ (see Table 9). AES acquired controlling stakes in two of these, Kyivoblenergo and Rivneoblenergo, in 2001. AES paid about US\$45.9m for the 75% stake in Kyivoblenergo and US\$23.2m for the 75% interest in Rivneoblenergo. The remaining 25% interests in both companies are either publicly traded or owned by employees. The holdings are part of the AES Silk Road subsidiary which controls AES’s businesses in Eurasia. AES has sold most of its non-US investments in the past two years and in May 2003, it was negotiating to sell its stakes to Vacuna International<sup>5</sup> registered in Luxembourg, but it appears that for the time being, AES is not planning to sell its shares.

**Table 9. Electricity distribution companies in Ukraine**

<b>Energo</b>	<b>Consumers</b>	<b>Owners (%)</b>
Kyivoblenergo	763,000	AES (75)
Rivneoblenergo	383,000	AES (75)
Zhytomyroblenergo	525,000	VSE (75.6)
Sevastopolmiskenergo	137,000	VSE (70)
Khersonoblenergo	594,000	VSE (65)
Kirovogradoblenergo	479,000	VSE (51)
Zaporozhyeoblenergo		RAO UESR, ECU (60)
Luganskoblenergo		RAO UESR, ECU (60)
Lvovoblenergo		RAO UESR, ECU (27)
Nikolaevoblenergo		RAO UESR, ECU (70)
Poltavaoblenergo		RAO UESR, ECU (25 + 1)
Prikarpatyeoblenergo		RAO UESR, ECU (25)
Sumyoblenergo		RAO UESR, ECU (25 + 1)
Ternopoloblenergo		RAO UESR, ECU (51)
Chernigovoblenergo		RAO UESR, ECU (25 + 1)
Odessaoblenergo		ECU (25)
Vinnitsaoblenergo		ECU (75)
Volynoblenergo		ECU (75)
Zakarpattyablenergo		ECU (75)
Dniprooblenergo		ECU (75)
Khmelnitskoblenergo		ECU (70)
Krymenergo		ECU (70)
Kharkhivenergo		ECU (65)
Donetskoblenergo		ECU (65)
Cherkassyoblenergo		ECU (46)
Chernovtsyoblenergo		ECU (70)
Ivano-Frankiskoblenergo		

Note: ECU ownership was as at the time of its establishment in June 2004.

At the same time as AES bought its stakes, the state-owned Slovak distribution company, Vychodoslovenske Energeticke Zavody (VSE), bought majority stakes in four oblenergos, Zhytomyroblenergo, Sevastopolmiskenergo, Khersonoblenergo and Kirovogradoblenergo. In March 2002, VSE transferred the shares to a subsidiary, VS Energy, registered in Netherlands in which it has a 90% stake. In January 2004, Vacuna International was negotiating to buy this stake, but the deal was not completed. In 2002, RWE, the German utility, acquired a 49% stake in VSE and subsequently Slovak law was changed to allow a majority stake to be taken in VSE (and the other Slovak distributors). It is expected RWE will take up this opportunity.

In November 2003, the state-owned Russian electric utility, RAO UESR, announced it had taken stakes of at least 16 in 10 oblenergos, although generally the stakes were less than controlling ones. It also said it

<sup>5</sup> It is not clear who is backing Vacuna. Vacuna International S.A. was described in the press as a holding company set up to manage assets. The company is also said to be active on the international financial and capital markets.

planned to increase these stakes by buying the government holdings in these companies to gain controlling stakes, but Ukraine refused to allow this while a majority of shares in RAO UESR were held by the Russian government.

### 2.4.3. Trade in power

Ukraine has for some time been attempting to increase exports of power, particularly to Western Europe (see Table 10). In 2003, the western part of Ukraine, so called "Burshtyn Island" upgraded its system according to UCTE (the system that supplies most of Western Europe) requirements and, after a successful one-year trial operation, the permanent synchronous connection was approved by UCTE in September 2003. This allows Ukraine to trade directly with Poland, Hungary and the Slovak Republic via links with a capacity of 450MW. There are plans to increase this capacity to 550MW by 2008.

Most of the Ukrainian system is synchronised to the Russian system. In December 2004, the commissioning of the Khmelnytsky 2 and Rovno 4 nuclear power plants (each 1000MW) allowed Energoatom to sign a deal with RAO UESR to export up to 500GWh per month (the equivalent to the output of a 700MW plant) to Russia at US\$11.4/MWh. Russia exports power to Moldova via the Ukrainian grid. Despite the completion of the two new nuclear units, exports of power in 2004 were 2% lower in 2004 compared to 2003, possibly due to the unscheduled shut-down of a number of nuclear plants in 2004.

**Table 10. Net electricity exports from Ukraine to UCTE countries (2003)**

	Net trade (GWh)
Hungary	4538
Poland	818
Slovak Rep	-1255
Total	4101

## 2.5. Policy issues for the Ukraine electricity sector

There would appear to be four main priority issues for the Ukrainian electricity sector for the next few years: the fate of the nuclear sector; improving the level of electricity bill payment; foreign investment in the electricity sector; and the proposed entry to the European Union.

### 2.5.1. The nuclear sector

Ukraine now has four nuclear power stations, Khmelnytski (2 units), Rovno (4 units), South Ukraine (3 units) and Zaporozhe (6 units). These units are of the VVER-1000 type or the VVER-440/213 design (two units at Rovno). The VVER design is similar to the Pressurised Water Reactor (PWR), the most widely used design in the West. The closure of the Chernobyl site (which housed four reactors of the RBMK design) means that none of the operating reactors are now of the type that the West has characterised as a priority for early closure and all the operating units should be able to operate to at least 2020 (assuming a lifetime of at least 40 years). Paying for the continued clean-up and surveillance at the Chernobyl site will require significant resources, some of which may be provided by the West.

The Khmelnytski 2 and Rovno 4 (K2R4) units were completed in 2004 and the European Bank for Reconstruction and Development (EBRD) may provide loans for the safety of these units to be upgraded to Western standards. Work on three further units (two at Khmelnytski and one at South Ukraine) has been started but has been stalled since 1990 with less than 30% of the work reported to have been completed on the furthest advanced plant (Khmelnytski 3). It has been reported work would now resume on Khmelnytski 3 but it remains to be seen whether this will happen. Work on the unit at South Ukraine is highly unlikely to restart on environmental grounds.

Ukraine already has a large surplus of capacity so completion of further nuclear plants would need to be justified on grounds other than capacity need, for example, reducing the cost of generation, allowing exports of power or replacing old capacity to reduce environmental impacts. In the election campaign, the new President, Victor Yushchenko, criticised the closure of the Chernobyl plants, mainly on grounds that the West did not provide support for their closure that it had promised. However, it is not clear whether he will support resumption of construction of Khmelnytski 3.

### **2.5.2. Improving the level of payment**

At its worst in 1998, the level of payment of electricity bills in cash was less than 10% with 77% paid by barter and the rest not paid at all. However, substantial efforts to improve payment rates coupled with economic recovery have led to a substantial improvement in this level. The level of payment by utilities grew from 80.6% in January through October 2003 to 89.2% in January through October 2004. Further improvements are expected although it is not clear whether tariff increases, which would tend to reduce the ability of consumers to pay, will be needed.

### **2.5.3. Foreign investment**

The prospects for further foreign investment in the electricity sector are very limited, with the notable exception of investment from Russia. Of the existing investors, AES did appear to be contemplating withdrawal in 2003, but at present they do not appear to have plans to sell. However, policies in this area can change quickly and it cannot be assumed that AES will continue to support its Ukrainian subsidiaries. Equally, the companies taken over by the Slovak company, VSE are now owned by the German company, RWE (which took a stake in VSE in 2002) and it is not clear whether these investments figure in RWE's strategic planning.

RAO UESR has invested in Ukraine, although the published details are sketchy and it is clear that there is a strong strategic and political incentive for Russia to invest in Ukraine. However, the fate of RAO UESR is unclear and it may not have the resources or the scope to expand its investments in Ukraine. It is not clear what policies the new President will follow on privatisation, in particular whether investment from Russia will be welcomed.

### **2.5.4. Proposed entry to the European Union**

President Yushchenko has strongly affirmed his commitment to take Ukraine into the European Union. Clearly this could not happen for several years, but as a condition of entry, Ukraine would have to comply with European rules on the electricity sector. If the current Directive is still in force, this would require, amongst other things, that all consumers should be able to choose their electricity supplier and that the owners of the transmission and distribution networks should be legally separate from generators or retail suppliers. Such a radical restructuring would be highly controversial and, if experience in the EU is anything to go by, would lead to substantial reductions in employment, a transfer of costs from large industrial consumers to residential consumers (because small consumers do not have strong bargaining power compared to large users) and could jeopardise security of supply.