Electricity Restructuring and Market Power: The Cases of Russia and Romania

Russell Pittman

Antitrust Division, U.S. Department of Justice, and

New Economic School, Moscow

2006 HERMES Workshop on Regulation and Competition Policy

Restructuring Railway, Postal and Electricity Sectors: Theory and Practice

Vertical separation in infrastructure sectors…

- "the new conventional wisdom" (Newbery, Laffont)
- Vs. Transactions Cost Economics
- Vs. other restructuring options:
  - 3rd party access
  - Competition among integrated firms
  - Regulation of vertically integrated monopoly

Vertical separation in infrastructure sectors…

- Benefits and costs
- Benefits: competition “upstream”
- Costs: loss of vertical economies

Creating competition in electricity generation markets

- Unique characteristics of electricity markets
- Very inelastic demand meeting very inelastic supply as capacity limitations approached
- Multi-”market” contact
- Incentives to earn rents on inframarginal capacity

Result: Monopoly power in markets that look competitive

- California
- Russia
- Romania

Table 1 - Structure of Russian Regional Markets

Company	Technology	Capacity	Capacity share	Cumulative	HHI
The Volga Region					
Tatenergo	CHP/GRES/hydro	6,986.00	29.61%	29.61%	876.65
TGK-7	CHP/GRES	5,800.70	24.58%	54.19%	604.41
Hydro OGK	hydro	5,007.00	21.22%	75.41%	450.33
RosAtom	nuclear	4,000.00	16.95%	92.37%	287.4
TGK-5	CHP	1,047.00	4.44%	96.80%	19.69
TGK-6	CHP	754	3.20%	100.00%	10.21
Total		23,594.70	100.00%		2,248.70
The Central Region					
RosAtom	nuclear	10,800.00	21.85%	21.85%	477.22
TGK-3	GRES/CHP	10,588.80	21.42%	43.26%	458.74
OGK-3	GRES	5,025.00	10.16%	53.43%	103.31
Hydro OGK	hydro	4,701.00	9.51%	62.94%	90.42
OGK-6	GRES	3,580.00	7.24%	70.18%	52.44
TGK-4	GRES/CHP	3,185.40	6.44%	76.62%	41.51
OGK-5	GRES	2,400.00	4.85%	81.48%	23.57
TGK-6	GRES/CHP	2,361.00	4.78%	86.25%	22.81
TGK-8	GRES/CHP	1,981.00	4.01%	90.26%	16.06
OGK-1	GRES	1,885.00	3.81%	94.07%	14.54
OGK-4	GRES	1,730.00	3.50%	97.57%	12.25
TGK-2	CHP	1,201.00	2.43%	100.00%	5.9
Total		49,438.20	100.00%		1,318.76
The Northwest Region					
TGK-1	GRES/CHP/hydro	6,065.05	34.09%	34.09%	1,161.83
RosAtom	nuclear	5,760.00	32.37%	66.46%	1,047.90
OGK-6	GRES	2,100.00	11.80%	78.26%	139.29
TGK-2	CHP	1,238.50	6.96%	85.22%	48.45
OGK-3	GRES	1,060.00	5.96%	91.18%	35.49
TGK-9	CHP	690	3.88%	95.05%	15.04
North-West CHP	CHP	450	2.53%	97.58%	6.4
OGK-2	GRES	430	2.42%	100.00%	5.84
Total		17,793.55	100.00%		2,460.23
The Siberia Region					
Irkutskenergo	hydro/CHP	12,975.90	27.14%	27.14%	736.78
Hydro OGK	hydro	10,176.00	21.29%	48.43%	453.12
Krasnoyarskaya GES	hydro	6,000.00	12.55%	60.98%	157.53
TGK-11	GRES/CHP	4,526.00	9.47%	70.45%	89.64
Novosibirskenergo	CHP	3,112.00	6.51%	76.96%	42.38
TGK-12	GRES/CHP	3,101.20	6.49%	83.45%	42.08
TGK-13	GRES/CHP	2,362.00	4.94%	88.39%	24.41
OGK-3	GRES	1,690.00	3.54%	91.92%	12.5
OGK-4	GRES	1,440.00	3.01%	94.93%	9.07
OGK-6	GRES	1,250.00	2.61%	97.55%	6.84
TGK-14	CHP	1,071.40	2.24%	99.79%	5.02
Mamakanskaya GES	hydro	100	0.21%	100.00%	0.04
Total		47,804.50	100.00%		1,579.42
The South Region					
Hydro OG K	hydro	3,067.72	25.83%	25.83%	667.22
OGK-2	GRES	2,400.00	20.21%	46.04%	408.37
OGK-6	GRES	2,245.00	18.90%	64.94%	357.33
TGK-8	CHP/hydro/GRES	1,823.60	15.35%	80.30%	235.77
OGK-5	GRES	1,340.00	11.28%	91.58%	127.31
RosAtom	nuclear	1,000.00	8.42%	100.00%	70.9
Total		11,876.32	100.00%		1,866.90
The Urals Region					
OGK-1	GRES	7,175.00	18.17%	18.17%	330.08
OGK-2	GRES	5,865.00	14.85%	33.02%	220.55
OGK-4	GRES	5,400.00	13.67%	46.69%	186.96
Bashkirenergo	CHP/GRES/hydro	5,113.79	12.95%	59.64%	167.67
OGK-5	GRES	5,005.00	12.67%	72.31%	160.61
TGK-10	CHP/GRES	2,947.00	7.46%	79.78%	55.68
TGK-9	CHP/GRES/hydro	2,556.40	6.47%	86.25%	41.9
Hydro OGK	hydro	1,482.00	3.75%	90.00%	14.08
TGK-5	CHP	1,426.30	3.61%	93.61%	13.04
TGK-7	CHP/hydro	1,040.00	2.63%	96.25%	6.93
OGK 3	GRES	882	2.23%	98.48%	4.99
RosAtom	nuclear	600	1.52%	100.00%	2.31

Note: OGK – Wholesale Generation Company; TGK – Territrial Generation Company; CHP – Combined Heat and Power Plant; GRES – State Regional Power Plant; CCGT – Combined Cycle Gas Turbine; DES – Diesel Power Station; GTS – Geothermal Power Station; GES – Hydro Power Plant.

Table 2 – Market structure of the Volga region during the spring season

Plant	Energo	Proposed Parent	Technology	Capacity	Capacity share	Cumulative capacity share
Base-load group						
Zhigulevskaya GES (F)		Hydro OGK	hydro	2,300.00	9.75%	9.75%
Saratovskaya GES (NF)		Hydro OGK	hydro	1,337.00	5.67%	15.41%
Cheboksarskaya GES (F)		Hydro OGK	hydro	1,370.00	5.81%	21. 22%
Balakovskaya NPP		RosAtom	nuclear	4,000.00	16.95%	38.17%
Nizhnekamskaya GES (F)	Tatenergo	Tatenergo	hydro	1,205.00	5.11%	43.28%
Non-base-load group						
CHP Volzhskogo Avtozavoda	Samaraenergo	TGK-7	CHP	1,172.00	4.97%	48.25%
Tolyattinskaya CHP	Samaraenergo	TGK-7	CHP	710	3.01%	51.26%
Novokuybyshevskaya CHP-2	Samaraenergo	TGK-7	CHP	470	1.99%	53.25%
Balakovskaya CHP-4	Saratovenergo	TGK-7	CHP	465	1.97%	55.22%
Saratovskaya CHP-5	Saratovenergo	TGK-7	CHP	440	1.86%	57.08%
Ulyanovskaya CHP-1	Ulyanovskenergo	TGK-7	CHP	435	1.84%	58.93%
Ulyanovskaya CHP-2	Ulyanovskenergo	TGK-7	CHP	417	1.77%	60.70%
Samarskaya CHP	Samaraenergo	TGK-7	CHP	390	1.65%	62.35%
Saratovskaya CHP-2	Saratovenergo	TGK-7	CHP	315	1.34%	63.68%
Syzranskaya CHP	Samaraenergo	TGK-7	CHP	255	1.08%	64.76%
Novokuybyshevskaya CHP-1	Samaraenergo	TGK-7	CHP	236	1.00%	65.76%
Engelsskaya CHP-3	Saratovenergo	TGK-7	CHP	202	0.86%	66.62%
Bezymyanskaya CHP	Samaraenergo	TGK-7	CHP	183.7	0.78%	67.40%
Saratovskaya GRES-CHP-1	Saratovenergo	TGK-7	CHP	57	0.24%	67.64%
Samarskaya GRES	Samaraenergo	TGK-7	GRES	53	0.22%	67.87%
Zainskaya GRES	Tatenergo	Tatenergo	GRES	2,400.00	10.17%	78.04%
Naberezhno-Chelninskaya CHP	Tatenergo	Tatenergo	CHP	1,180.00	5.00%	83.04%
Nizhnekamskaya CHP-1	Tatenergo	Tatenergo	CHP	850	3.60%	86.64%
Nizhnekamskaya CHP-2	Tatenergo	Tatenergo	CHP	420	1.78%	88.42%
Kazanskaya CHP-3	Tatenergo	Tatenergo	CHP	405	1.72%	90.14%
Kazanskaya CHP-1	Tatenergo	Tatenergo	CHP	190	0.81%	90.94%
Kazanskaya CHP-2	Tatenergo	Tatenergo	CHP	175	0.74%	91.68%
Urussinskaya GRES	Tatenergo	Tatenergo	GRES	161	0.68%	92.37%
Cheboksarskaya CHP-2	Chuvashenergo	TGK-5	CHP	460	1.95%	94.32%
Novocheboksarskaya CHP-3	Chuvashenergo	TGK-5	CHP	380	1.61%	95.93%
Yoshkar-Olinskaya CHP	Marienergo	TGK-5	CHP	195	0.83%	96.75%
Cheboksarskaya CHP-1	Chuvashenergo	TGK-5	CHP	12	0.05%	96.80%
CHP-1	Penzaenergo	TGK-6	CHP	385	1.63%	98.44%
Saranskaya CHP-2	Mordovenergo	TGK-6	CHP	340	1.44%	99.88%
CHP-2	Penzaenergo	TGK-6	CHP	16	0.07%	99.94%
Alekseevskaya CHP-3	Mordovenergo	TGK-6	CHP	9	0.04%	99.98%
CHP-3	Penzaenergo	TGK-6	CHP	4	0.02%	100.00%

Source: Annual reports of AO-energos and Federal power plants.
Note: All hydro power plants marked either F or NF. F stands for flexible plant while NF – for non-flexible. Flexibility is defined in terms of plant's constant ability to cover peaks of demand for electric power.

Table 3 – Market structure of the Volga region during summer and fall season

Plant	Energo	Proposed Parent	Technology	Capacity	Capacity share	Cumulative capacity share
Base-load group						
Balakovskaya NPP		RosAtom	nuclear	4,000.00	17.94%	17.94%
Saratovskaya GES (NF)		Hydro OGK	hydro	1,058.00	4.74%	22.68%
Non-baseload group						
Zhigulevskaya GES (F)		Hydro OGK	hydro	1,820.00	8.16%	30.85%
Cheboksarskaya GES (F)		Hydro OGK	hydro	1,084.10	4.86%	35.71%
Zainskaya GRES	Tatenergo	Tatenergo	GRES	2,400.00	10.76%	46.47%
Naberezhno-Chelninskaya CHP	Tatenergo	Tatenergo	CHP	1,180.00	5.29%	51.76%
Nizhnekamskaya GES (F)	Tatenergo	Tatenergo	hydro	953.5	4.28%	56.04%
Nizhnekamskaya CHP-1	Tatenergo	Tatenergo	CHP	850	3.81%	59.85%
Nizhnekamskaya CHP-2	Tatenergo	Tatenergo	CHP	420	1.88%	61.73%
Kazanskaya CHP-3	Tatenergo	Tatenergo	CHP	405	1.82%	63.55%
Kazanskaya CHP-1	Tatenergo	Tatenergo	CHP	190	0.85%	64.40%
Kazanskaya CHP-2	Tatenergo	Tatenergo	CHP	175	0.78%	65.19%
Urussinskaya GRES	Tatenergo	Tatenergo	GRES	161	0.72%	65.91%
CHP Volzhskogo Avtozavoda	Samaraenergo	TGK-7	CHP	1,172.00	5.26%	71.17%
Tolyattinskaya CHP	Samaraenergo	TGK-7	CHP	710	3.18%	74.35%
Novokuybyshevskaya CHP-2	Samaraenergo	TGK-7	CHP	470	2.11%	76.46%
Balakovskaya CHP-4	Saratovenergo	TGK-7	CHP	465	2.09%	78.54%
Saratovskaya CHP-5	Saratovenergo	TGK-7	CHP	440	1.97%	80.52%
Ulyanovskaya CHP-1	Ulyanovskenergo	TGK-7	CHP	435	1.95%	82.47%
Ulyanovskaya CHP-2	Ulyanovskenergo	TGK-7	CHP	417	1.87%	84.34%
Samarskaya CHP	Samaraenergo	TGK-7	CHP	390	1.75%	86.09%
Saratovskaya CHP-2	Saratovenergo	TGK-7	CHP	315	1.41%	87.50%
Syzranskaya CHP	Samaraenergo	TGK-7	CHP	255	1.14%	88.64%
Novokuybyshevskaya CHP-1	Samaraenergo	TGK-7	CHP	236	1.06%	89.70%
Engelsskaya CHP-3	Saratovenergo	TGK-7	CHP	202	0.91%	90.61%
Bezymyanskaya CHP	Samaraenergo	TGK-7	CHP	183.7	0.82%	91.43%
Saratovskaya GRES-CHP-1	Saratovenergo	TGK-7	CHP	57	0.26%	91.69%
Samarskaya GRES	Samaraenergo	TGK-7	GRES	53	0.24%	91.92%
Cheboksarskaya CHP-2	Chuvashenergo	TGK-5	CHP	460	2.06%	93.99%
Novocheboksarskaya CHP-3	Chuvashenergo	TGK-5	CHP	380	1.70%	95.69%
Yoshkar-Olinskaya CHP	Marienergo	TGK-5	CHP	195	0.87%	96.56%
Cheboksarskaya CHP-1	Chuvashenergo	TGK-5	CHP	12	0.05%	96.62%
CHP-1	Penzaenergo	TGK-6	CHP	385	1.73%	98.35%
Saranskaya CHP-2	Mordovenergo	TGK-6	CHP	340	1.52%	99.87%
CHP-2	Penzaenergo	TGK-6	CHP	16	0.07%	99.94%
Alekseevskaya CHP-3	Mordovenergo	TGK-6	CHP	9	0.04%	99.98%
CHP-3	Penzaenergo	TGK-6	CHP	4	0.02%	100.00%

Table 4 – Market structure of the Volga region during the winter season

Plant	Energo	Proposed Parent	Technology	Capacity	Capacity share	Cumulative capacity
Base-load group						
CHP Volzhskogo Avtozavoda	SamaraEnergo	TGK-7	CHP	1,172.00	5.36%	5.36%
Tolyattinskaya CHP	SamaraEnergo	TGK-7	CHP	710	3.25%	8.61%
Novokuybyshevskaya CHP-2	SamaraEnergo	TGK-7	CHP	470	2.15%	10.75%
Balakovskaya CHP-4	SaratovEnergo	TGK-7	CHP	465	2.13%	12.88%
Saratovskaya CHP-5	SaratovEnergo	TGK-7	CHP	440	2.01%	14.89%
Ulyanovskaya CHP-1	UlyanovskEnergo	TGK-7	CHP	435	1.99%	16.88%
Ulyanovskaya CHP-2	UlyanovskEnergo	TGK-7	CHP	417	1.91%	18.79%
Samarskaya CHP	SamaraEnergo	TGK-7	CHP	390	1.78%	20.57%
Saratovskaya CHP-2	SaratovEnergo	TGK-7	CHP	315	1.44%	22.01%
Syzranskaya CHP	SamaraEnergo	TGK-7	CHP	255	1.17%	23.18%
Novokuybyshevskaya CHP-1	SamaraEnergo	TGK-7	CHP	236	1.08%	24.26%
Engelsskaya CHP-3	SaratovEnergo	TGK-7	CHP	202	0.92%	25.18%
Bezymyanskaya CHP	SamaraEnergo	TGK-7	CHP	183.7	0.84%	26.02%
Saratovskaya GRES-CHP-1	SaratovEnergo	TGK-7	CHP	57	0.26%	26.28%
Balakovskaya NPP		RosAtom	nuclear	4,000.00	18.29%	44.57%
Naberezhno-Chelninskaya CHP	Tatenergo	Tatenergo	CHP	1,180.00	5.40%	49.97%
Nizhnekamskaya CHP-1	Tatenergo	Tatenergo	CHP	850	3.89%	53.86%
Nizhnekamskaya CHP-2	Tatenergo	Tatenergo	CHP	420	1.92%	55.78%
Kazanskaya CHP-3	Tatenergo	Tatenergo	CHP	405	1.85%	57.63%
Kazanskaya CHP-1	Tatenergo	Tatenergo	CHP	190	0.87%	58.50%
Kazanskaya CHP-2	Tatenergo	Tatenergo	CHP	175	0.80%	59.30%
Saratovskaya GES (NF)		Hydro OGK	hydro	965.6	4.42%	63.71%
Cheboksarskaya CHP-2	ChuvashEnergo	TGK-5	CHP	460	2.10%	65.82%
Novocheboksarskaya CHP-3	ChuvashEnergo	TGK-5	CHP	380	1.74%	67.55%
Yoshkar-Olinskaya CHP	MariEnergo	TGK-5	CHP	195	0.89%	68.45%
Cheboksarskaya CHP-1	ChuvashEnergo	TGK-5	CHP	12	0.05%	68.50%
CHP-1	PenzaEnergo	TGK-6	CHP	385	1.76%	70.26%
Saranskaya CHP-2	MordovEnergo	TGK-6	CHP	340	1.55%	71.82%
CHP-2	PenzaEnergo	TGK-6	CHP	16	0.07%	71.89%
Alekseevskaya CHP-3	MordovEnergo	TGK-6	CHP	9	0.04%	71.93%
CHP-3	PenzaEnergo	TGK-6	CHP	4	0.02%	71.95%
Non-base-load group						
Zhigulevskaya GES (F)		Hydro OGK	hydro	1,661.10	7.60%	79.54%
Cheboksarskaya GES (F)		Hydro OGK	hydro	989.4	4.52%	84.07%
Zainskaya GRES	Tatenergo	Tatenergo	GRES	2,400.00	10.97%	95.04%
Nizhnekamskaya GES (F)	Tatenergo	Tatenergo	hydro	870.3	3.98%	99.02%
Urussinskaya GRES	Tatenergo	Tatenergo	GRES	161	0.74%	99.76%
Samarskaya GRES	SamaraEnergo	TGK-7	GRES	53	0.24%	100.00%

TABLE 5. STRUCTURE OF ROMANIAN GENERATION SECTOR

POWER STATION	NET OUTPUT	NET OUTPUT SHARE(%	TECHNOLOGY	COGENERATION (Electricity and Heat)	CUMULATIVE NET OUTPUT SHARE(%)
			Base-load group		
TURCENI	5297923	10.25	brown coal	NO	10.25
ROVINARI	5245301	10.15	brown coal	NO	20.41
SNN	5142397	9.95	uranium	NO	30.36
OLT	2696000	5.22	other hydro		35.58
ISALNITA	2677667	5.18	brown coal	NO	40.76
RAAN	1367142	2.65	brown coal	YES	43.41
CRAIOVA II	748805	1.45	brown coal	YES	44.86
OTHERS	678000	1.31	other hydro		46.17
GOVORA	581091	1.12	brown coal, nat gas, black oi	YES	47.29
SIRET	423000	0.82	other hydro		48.11
ARAD	297311	0.58	brown coal	YES	48.69
ORADEA	265850	0.51	brown coal	YES	49.20
BACAU	215059	0.42	brown coal	YES	49.62
DOICESTI	194920	0.38	brown coal	NO	49.99
BRASOV	191023	0.37	brown coal	YES	50.36
PRUT	70000	0.14	other hydro		50.50
JIU	49000	0.09	other hydro		50.59
			Non-base-load group		
PF I	5692000	11.02	hydro with holding ponds		61.61
DEVA	3317992	6.42	pit oil	YES	68.03
BUCURESTI (LUDOS IERNUT,MURE	2055694	3.98	nat gas	NO	72.01
BUCURESTI (SUD)	1543069	2.99	nat gas+black oil	YES	75.00
PF II + GOGOSU	1501000	2.91	hydro with holding ponds		77.90
LOTRU	933000	1.81	hydro with holding ponds		79.71
GALATI	853894	1.65	nat gas+black oil	YES	81.36
BUCURESTI (VEST)	827925	1.60	nat gas+black oil	YES	82.96
BISTRITA	775000	1.50	hydro with holding ponds		84.46
ARGES	715000	1.38	hydro with holding ponds		85.85
BRAILA	681508	1.32	nat gas+black oil	NO	87.17
SOMES	648000	1.25	hydro with holding ponds		88.42
PLOIESTI	553902	1.07	nat gas+ black oil	YES	89.49
IASI	547943	1.06	brown coal, nat gas, black oi	YES	90.55
SEBES	526000	1.02	hydro with holding ponds		91.57
RAUL MARE	512000	0.99	hydro with holding ponds		92.56
BUCURESTI (PROGRESUL)	456391	0.88	nat gas+black oil	YES	93.45
DRAGAN	420000	0.81	hydro with holding ponds		94.26
CERNA	373000	0.72	hydro with holding ponds		94.98
BUCURESTI (PALAS, CONSTANTA)	329233	0.64	nat gas+black oil	YES	95.62
SNP-PETROBRAZI	327233	0.63	natural gas	YES	96.25
BUCURESTI (GROZAVESTI)	293154	0.57	nat gas+black oil	YES	96.82
PITESTI	270292	0.52	nat gas+ black oil	YES	97.34
ONESTI	238805	0.46	nat gas	YES	97.80
BORZESTI - K	237814	0.46	nat gas+black oil	NO	98.26
SUCEAVA	220055	0.43	pit oil	YES	98.69
PAROSENI	192803	0.37	pit oil	YES	99.06
BISTRA	148000	0.29	hydro with holding ponds		99.35
BUZAU	141000	0.27	hydro with holding ponds		99.62
GIURGIU	90332	0.17	pit oil	YES	99.80
DAMBOVITA	59000	0.11	hydro with holding ponds		99.91
RAUL TARGULUI	31000	0.06	hydro with holding ponds		99.97
BUCURESTI (TITAN)	14269	0.03	nat gas+black oil	YES	100.00

NON-BASE-LOAD GROUP

POWER STATION	NET OUTPUT	NET OUTPUT SHARE(%)	TECHNOLOGY	COGENERATION (Electricity and Heat)	CUMULATIVE NET OUTPUT SHARE(%)
PF I	5692000	11.02	hydro with holding ponds		11.02
DEVA	3317992	6.42	pit oil	YES	17.44
BUCURESTI (LUDOS IERNUT	2055694	3.98	nat gas	NO	21.42
BUCURESTI (SUD)	1543069	2.99	nat gas+black oil	YES	24.41
PF II + GOGOSU	1501000	2.91	hydro with holding ponds		27.31
LOTRU	933000	1.81	hydro with holding ponds		29.12
GALATI	853894	1.65	nat gas+black oil	YES	30.77
BUCURESTI (VEST)	827925	1.60	nat gas+black oil	YES	32.37
BISTRITA	775000	1.50	hydro with holding ponds		33.87
ARGES	715000	1.38	hydro with holding ponds		35.26
BRAILA	681508	1.32	nat gas+black oil	NO	36.58
SOMES	648000	1.25	hydro with holding ponds		37.83
PLOIESTI	553902	1.07	nat gas+ black oil	YES	38.90
IASI	547943	1.06	brown coal, nat gas, black oil	YES	39.96
SEBES	526000	1.02	hydro with holding ponds		40.98
RAUL MARE	512000	0.99	hydro with holding ponds		41.97
BUCURESTI (PROGRESUL)	456391	0.88	nat gas+black oil	YES	42.86
DRAGAN	420000	0.81	hydro with holding ponds		43.67
CERNA	373000	0.72	hydro with holding ponds		44.39
BUCURESTI (PALAS, CONST	329233	0.64	nat gas+black oil	YES	45.03
SNP-PETROBRAZI	327233	0.63	natural gas	YES	45.66
BUCURESTI (GROZAVESTI)	293154	0.57	nat gas+black oil	YES	46.23
PITESTI	270292	0.52	nat gas+ black oil	YES	46.75
ONESTI	238805	0.46	nat gas	YES	47.21
BORZESTI - K	237814	0.46	nat gas+black oil	NO	47.67
SUCEAVA	220055	0.43	pit oil	YES	48.10
PAROSENI	192803	0.37	pit oil	YES	48.47
BISTRA	148000	0.29	hydro with holding ponds		48.76
BUZAU	141000	0.27	hydro with holding ponds		49.03
GIURGIU	90332	0.17	pit oil	YES	49.21
DAMBOVITA	59000	0.11	hydro with holding ponds		49.32
RAUL TARGULUI	31000	0.06	hydro with holding ponds		49.38
BUCURESTI (TITAN)	14269	0.03	nat gas+black oil	YES	49.41

HYDRO AND NON-HYDRO

POWER STATION	NET OUTPUT	NET OUTPUT SHARE(%)	TECHNOLOGY	COGENERATION (Electricity and Heat)	CUMULATIVE NET OUTPUT SHARE(%)
PF I	5692000	11.02	hydro with holding ponds		11.02
PF II + GOGOSU	1501000	2.91	hydro with holding ponds		13.93
LOTRU	933000	1.81	hydro with holding ponds		15.73
BISTRITA	775000	1.50	hydro with holding ponds		17.23
ARGES	715000	1.38	hydro with holding ponds		18.61
SOMES	648000	1.25	hydro with holding ponds		19.87
SEBES	526000	1.02	hydro with holding ponds		20.89
RAUL MARE	512000	0.99	hydro with holding ponds		21.88
DRAGAN	420000	0.81	hydro with holding ponds		22.69
CERNA	373000	0.72	hydro with holding ponds		23.41
BISTRA	148000	0.29	hydro with holding ponds		23.70
BUZAU	141000	0.27	hydro with holding ponds		23.97
DAMBOVITA	59000	0.11	hydro with holding ponds		24.09
RAUL TARGULUI	31000	0.06	hydro with holding ponds		24.15
DEVA	3317992	6.42	pit oil	YES	30.57
BUCURESTI (LUDOS IERNUT,MURES)	2055694	3.98	nat gas	NO	34.55
BUCURESTI (SUD)	1543069	2.99	nat gas+black oil	YES	37.53
GALATI	853894	1.65	nat gas+black oil	YES	39.19
BUCURESTI (VEST)	827925	1.60	nat gas+black oil	YES	40.79
BRAILA	681508	1.32	nat gas+black oil	NO	42.11
PLOIESTI	553902	1.07	nat gas+ black oil	YES	43.18
IASI	547943	1.06	brown coal, nat gas, black oil	YES	44.24
BUCURESTI (PROGRESUL)	456391	0.88	nat gas+black oil	YES	45.12
BUCURESTI (PALAS, CONSTANTA)	329233	0.64	nat gas+black oil	YES	45.76
SNP-PETROBRAZI	327233	0.63	natural gas	YES	46.39
BUCURESTI (GROZAVESTI)	293154	0.57	nat gas+black oil	YES	46.96
PITESTI	270292	0.52	nat gas+ black oil	YES	47.48
ONESTI	238805	0.46	nat gas	YES	47.95
BORZESTI - K	237814	0.46	nat gas+black oil	NO	48.41
SUCEAVA	220055	0.43	pit oil	YES	48.83
PAROSENI	192803	0.37	pit oil	YES	49.21
GIURGIU	90332	0.17	pit oil	YES	49.38
BUCURESTI (TITAN)	14269	0.03	nat gas+black oil	YES	49.41

TABLE 6. STRUCTURE OF ROMANIAN GENERATION SECTOR IN WINTER, WHEN CHP PLANTS BECOME BASELOAD

POWER STATION	NET OUTPUT	NET OUTPUT SHARE(%	TECHNOLOGY	COGENERATION (Electricity and Heat)	CUMULATIVE NET OUTPUT SHARE(%)
			Base-load group		
TURCENI	5297923	10.25	brown coal	NO	10.25
ROVINARI	5245301	10.15	brown coal	NO	20.41
SNN	5142397	9.95	uranium	NO	30.36
DEVA	3317992	6.42	pit oil	YES	36.78
OLT	2696000	5.22	other hydro		42.00
ISALNITA	2677667	5.18	brown coal	NO	47.18
BUCURESTI (SUD)	1543069	2.99	nat gas+black oil	YES	50.17
RAAN	1367142	2.65	brown coal	YES	52.81
GALATI	853894	1.65	nat gas+black oil	YES	54.47
BUCURESTI (VEST)	827925	1.60	nat gas+black oil	YES	56.07
CRAIOVA II	748805	1.45	brown coal	YES	57.52
OTHERS	678000	1.31	other hydro		58.83
GOVORA	581091	1.12	brown coal, nat gas, black oil	YES	59.96
PLOIESTI	553902	1.07	nat gas+ black oil	YES	61.03
IASI	547943	1.06	brown coal, nat gas, black oil	YES	62.09
BUCURESTI (PROGRESUL)	456391	0.88	nat gas+black oil	YES	62.97
SIRET	423000	0.82	other hydro		63.79
BUCURESTI (PALAS, CONSTANTA)	329233	0.64	nat gas+black oil	YES	64.43
SNP-PETROBRAZI	327233	0.63	natural gas	YES	65.06
ARAD	297311	0.58	brown coal	YES	65.64
BUCURESTI (GROZAVESTI)	293154	0.57	nat gas+black oil	YES	66.20
PITESTI	270292	0.52	nat gas+ black oil	YES	66.73
ORADEA	265850	0.51	brown coal	YES	67.24
ONESTI	238805	0.46	nat gas	YES	67.70
SUCEAVA	220055	0.43	pit oil	YES	68.13
BACAU	215059	0.42	brown coal	YES	68.55
DOICESTI	194920	0.38	brown coal	NO	68.92
PAROSENI	192803	0.37	pit oil	YES	69.30
BRASOV	191023	0.37	brown coal	YES	69.67
GIURGIU	90332	0.17	pit oil	YES	69.84
PRUT	70000	0.14	other hydro		69.98
JIU	49000	0.09	other hydro		70.07
BUCURESTI (TITAN)	14269	0.03	nat gas+black oil	YES	70.10
			Non-base-load group		
PF I	5692000	11.02	hydro with holding ponds		81.12
BUCURESTI (LUDOS IERNUT, MURES)	2055694	3.98	nat gas	NO	85.09
PF II + GOGOSU	1501000	2.91	hydro with holding ponds		88.00
LOTRU	933000	1.81	hydro with holding ponds		89.81
BISTRITA	775000	1.50	hydro with holding ponds		91.31
ARGES	715000	1.38	hydro with holding ponds		92.69
BRAILA	681508	1.32	nat gas+black oil	NO	94.01
SOMES	648000	1.25	hydro with holding ponds		95.26
SEBES	526000	1.02	hydro with holding ponds		96.28
RAUL MARE	512000	0.99	hydro with holding ponds		97.27
DRAGAN	420000	0.81	hydro with holding ponds		98.08
CERNA	373000	0.72	hydro with holding ponds		98.81
BORZESTI - K	237814	0.46	nat gas+black oil	NO	99.27
BISTRA	148000	0.29	hydro with holding ponds		99.55
BUZAU	141000	0.27	hydro with holding ponds		99.83
DAMBOVITA	59000	0.11	hydro with holding ponds		99.94
RAUL TARGULUI	31000	0.06	hydro with holding ponds		100.00

NON-BASE-LOAD GROUP

POWER STATION	NET OUTPUT	NET OUTPUT SHARE(%)	TECHNOLOGY	COGENERATION (Electricity and Heat)	CUMULATIVE NET OUTPUT SHARE(%)
			Non-base-load group		
PF I	5692000	11.02	hydro with holding ponds		11.02
BUCURESTI (LUDOS IERNUT, MURES)	2055694	3.98	nat gas	NO	15.00
PF II + GOGOSU	1501000	2.91	hydro with holding ponds		17.90
LOTRU	933000	1.81	hydro with holding ponds		19.71
BISTRITA	775000	1.50	hydro with holding ponds		21.21
ARGES	715000	1.38	hydro with holding ponds		22.59
BRAILA	681508	1.32	nat gas+black oil	NO	23.91
SOMES	648000	1.25	hydro with holding ponds		25.17
SEBES	526000	1.02	hydro with holding ponds		26.18
RAUL MARE	512000	0.99	hydro with holding ponds		27.18
DRAGAN	420000	0.81	hydro with holding ponds		27.99
CERNA	373000	0.72	hydro with holding ponds		28.71
BORZESTI - K	237814	0.46	nat gas+black oil	NO	29.17
BISTRA	148000	0.29	hydro with holding ponds		29.46
BUZAU	141000	0.27	hydro with holding ponds		29.73
DAMBOVITA	59000	0.11	hydro with holding ponds		29.84
RAUL TARGULUI	31000	0.06	hydro with holding ponds		29.90

HYDRO AND NON-HYDRO

POWER STATION	NET OUTPUT	NET OUTPUT SHARE(%)	TECHNOLOGY	COGENERATION (Electricity and Heat)	CUMULATIVE NET OUTPUT SHARE(%)
PF I	5692000	11.02	hydro with holding ponds		11.02
PF II + GOGOSU	1501000	2.91	hydro with holding ponds		13.93
LOTRU	933000	1.81	hydro with holding ponds		15.73
BISTRITA	775000	1.50	hydro with holding ponds		17.23
ARGES	715000	1.38	hydro with holding ponds		18.61
SOMES	648000	1.25	hydro with holding ponds		19.87
SEBES	526000	1.02	hydro with holding ponds		20.89
RAUL MARE	512000	0.99	hydro with holding ponds		21.88
DRAGAN	420000	0.81	hydro with holding ponds		22.69
CERNA	373000	0.72	hydro with holding ponds		23.41
BISTRA	148000	0.29	hydro with holding ponds		23.70
BUZAU	141000	0.27	hydro with holding ponds		23.97
DAMBOVITA	59000	0.11	hydro with holding ponds		24.09
RAUL TARGULUI	31000	0.06	hydro with holding ponds		24.15
BUCURESTI (LUDOS IERNUT, MURES)	2055694	3.98	nat gas	NO	28.13
BRAILA	681508	1.32	nat gas+black oil	NO	29.44
BORZESTI - K	237814	0.46	nat gas+black oil	NO	29.90

Policy alternatives?

- Increase elasticity of demand
  - E.g., real-time pricing
- Increase elasticity of supply
  - E.g., removing transmission bottlenecks
- Reduce incentives to manipulate price
  - E.g., long-term contracts
  - E.g., further horizontal restructuring
  - E.g., capacity payments
- “Back to the drawing board?”