ENERGY REGULATORY OFFICE

Kosovo within the framework of Energy Community of SEE

10th National Conference "Energy & Development"
Athens - December 2005

ERO
www.ero-ks.org

General Profile - Kosovo

Administrated by the United Nations Interim Administration Mission in Kosovo (UNMIK)

Kosovo has an elected Assembly and Provisional Institutions of Self-Government (PISG) responsible for certain policy areas, including energy and mining sectors.

Continental climate
-warm summers
(a. 22 °C, h. 38 °C)
-cold winters
(a. -1 °C, l. -22 °C)

Official currency – Euro (€)
- **GDP (2004) – 1,845 mil €**
- **GDP/capita – approx. 900 €**
- **Unemployment rate 54%**

- **Average increase of CPI Sep 04/Sept 05 (1.3%)**
- **Econ. Growth Rate (3.2 %)**

ERO
www.ero-ks.org

Power Generation and Capacity

Go to: Lignite Reserves

Lignite Fired Power Plant	Years of Const.	Technology - Manufacturer	Technology - Manufacturer	Installed capacity	Operat. Capacity	Load Factor (2004)	Net Production 2004	Prod. 2004	Net Pro. (Jan-Sept) 2005*	Prod. (Jan-Sept) 2005	Draft Power Balance for 2006	PP Prod. 2006
Units	*year*	*Boiler*	*Turbine-Generator*	*[MW]*	*[MW]*	*%*	*[GWh]*	*%*	*[GWh]*	*%*	*[GWh]*	*%*
A1	1962	Steam Boiler-Babckock	Westinghouse	65	25	2.47%	5.4	0.16%	40.2	1.15%	55.8	1.60%
A2	1964	Steam Boiler-Babckock	Westinghouse	125	-	-	0.0	0.00%	0.0	0.00%	0.0	0.00%
A3	1970	Steam Boiler-RAFAKO	LMZ - Elektrotjazmaz	200	95 (0)	33.79%	281.2	8.07%	- 2.4	-0.07%	457.9	13.14%
A4	1971	Steam Boiler-RAFAKO	LMZ - Elektrotjazmaz	200	-	-	115.0	3.30%	- 0.8	-0.02%	0.0	0.00%
A5	1975	Steam Boiler-RAFAKO	LMZ - Elektrotjazmaz	210	110	46.77%	450.7	12.94%	455.5	13.08%	471.2	13.53%
Total Kosova A		Pulvrized Fired		800	230 (135)	28.75%	852.3	24.47%	492.5	17.34%	984.9	23.43%
B1	1983	Steam Boiler-Sten Industry	MAN - Alstom	339	285	57.43%	1 433.7	41.16%	991.3	34.90%	1 611.0	38.33%
B2	1984	Steam Boiler-Sten Industry	MAN - Alstom	339	285	43.50%	1 086.1	31.18%	1 277.3	44.98%	1 519.1	36.14%
Total Kosova B		Pulvrized Fired		678	570	50.46%	2 519.8	72.33%	2 268.6	79.88%	3 130.1	74.47%
HPP Ujmani	1981	Hydro PP	Hydro PP	35	35	36.37%	111.5	3.20%	78.9	2.78%	88.0	2.09%
Total				1513	835 (740)	55.18%	3 483.6	100.00%	2 840.0	100.00%	4 203.0	100.00%

ToR

Due to
- inadequate maintenance
- irrational use during pre-war period
- war impairments

Current used capacity is less than 50% of installed capacity

ERO
www.ero-ks.org

Demand for Electricity Import

- **Annual Electricity Demand approx. 4.3 TWh**
- **Peak Load 885 MW**

During 2004 were applied load shedding;

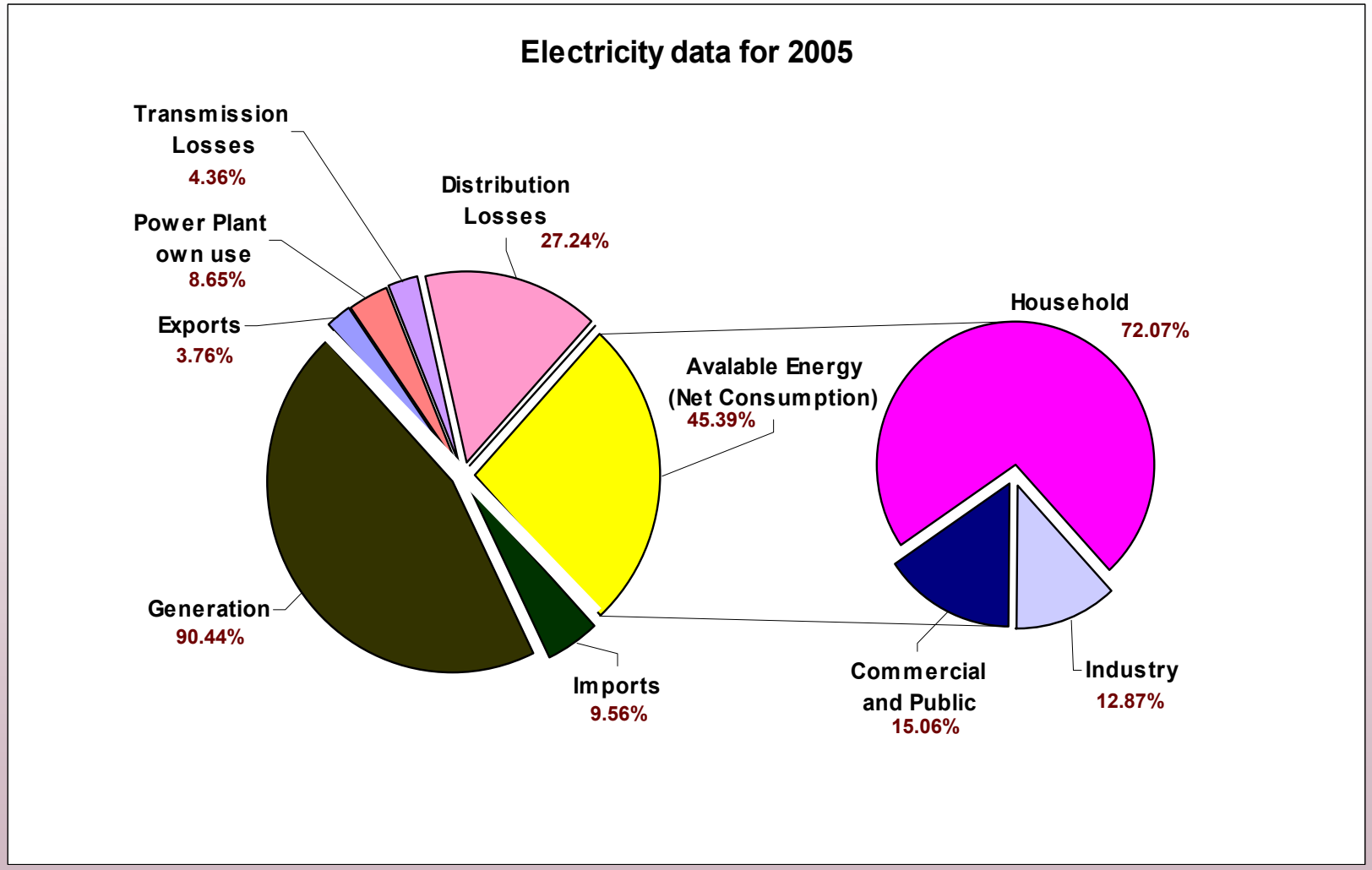
4:2 during peak time and winter

5:1 during base load and summer

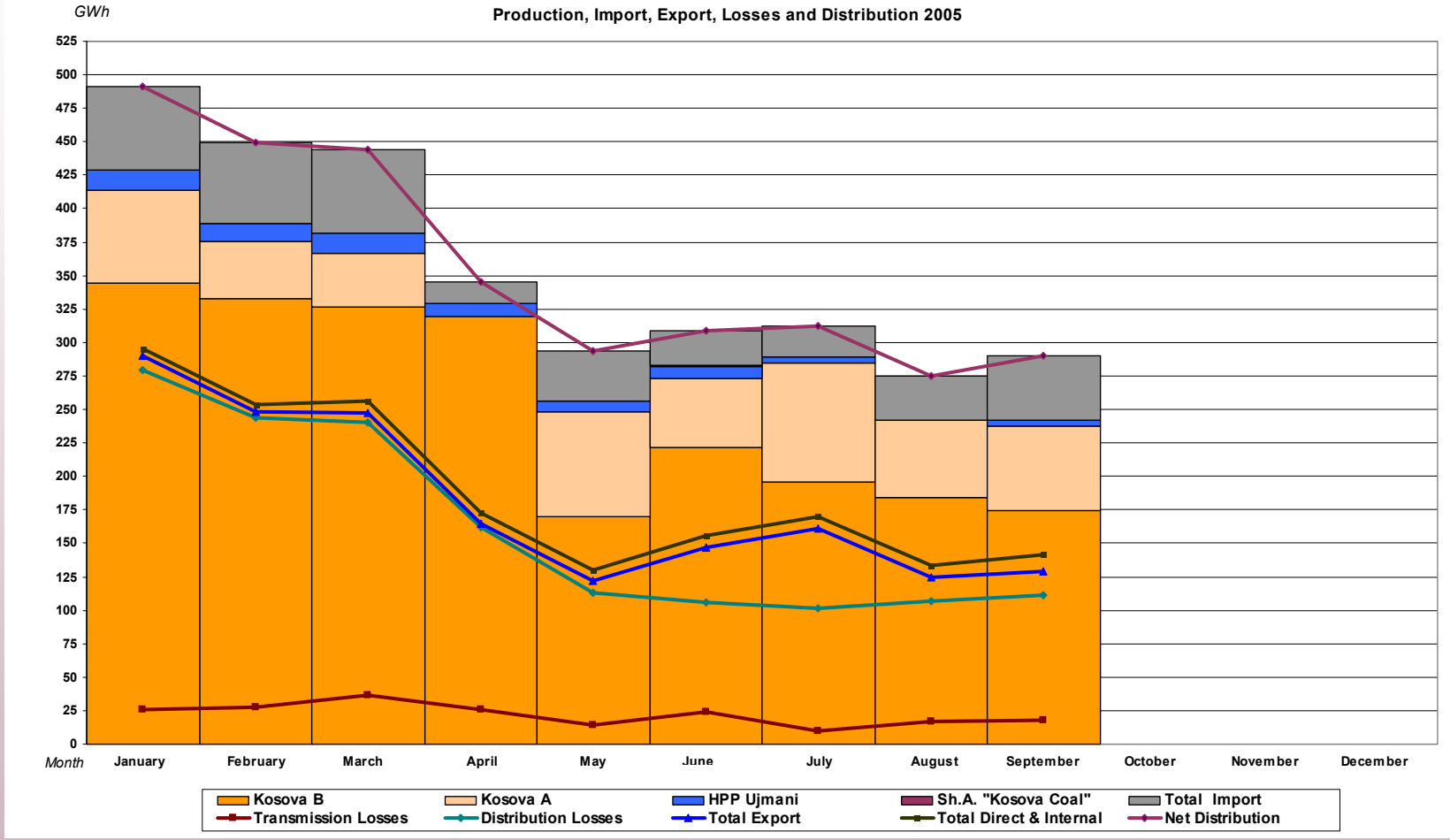
Similar situation is (foreseen) in 2005

Import	Realized 2004		Realized 2005		PB 2006
	MWh	€/MWh	MWh	€/MWh	MWh
January	148 180	*43.75*	59 750	*45.86*	42 126
February	47 670	*38.06*	58 890	*45.07*	26 544
March	32 730	*37.20*	47 180	*42.90*	2 627
April	12 245	*34.50*	3 250	*53.50*	63 944
May	11 290	*36.00*	0	*0.00*	0
June	4 000	*36.00*	17 220	*44.23*	0
July	1 630	*49.28*	10 695	*59.50*	22 052
August	16 740	*37.00*	21 240	*58.60*	45 434
September	103 795	*39.00*	43 430	*57.30*	66 167
October	15 220	*49.11*			43 729
November	40 310	*54.50*			65 366
December	39 470	*41.50*			42 002
Total	473 280	*39.64*	261 655	*48.63*	419 991

Power Balance for 2005



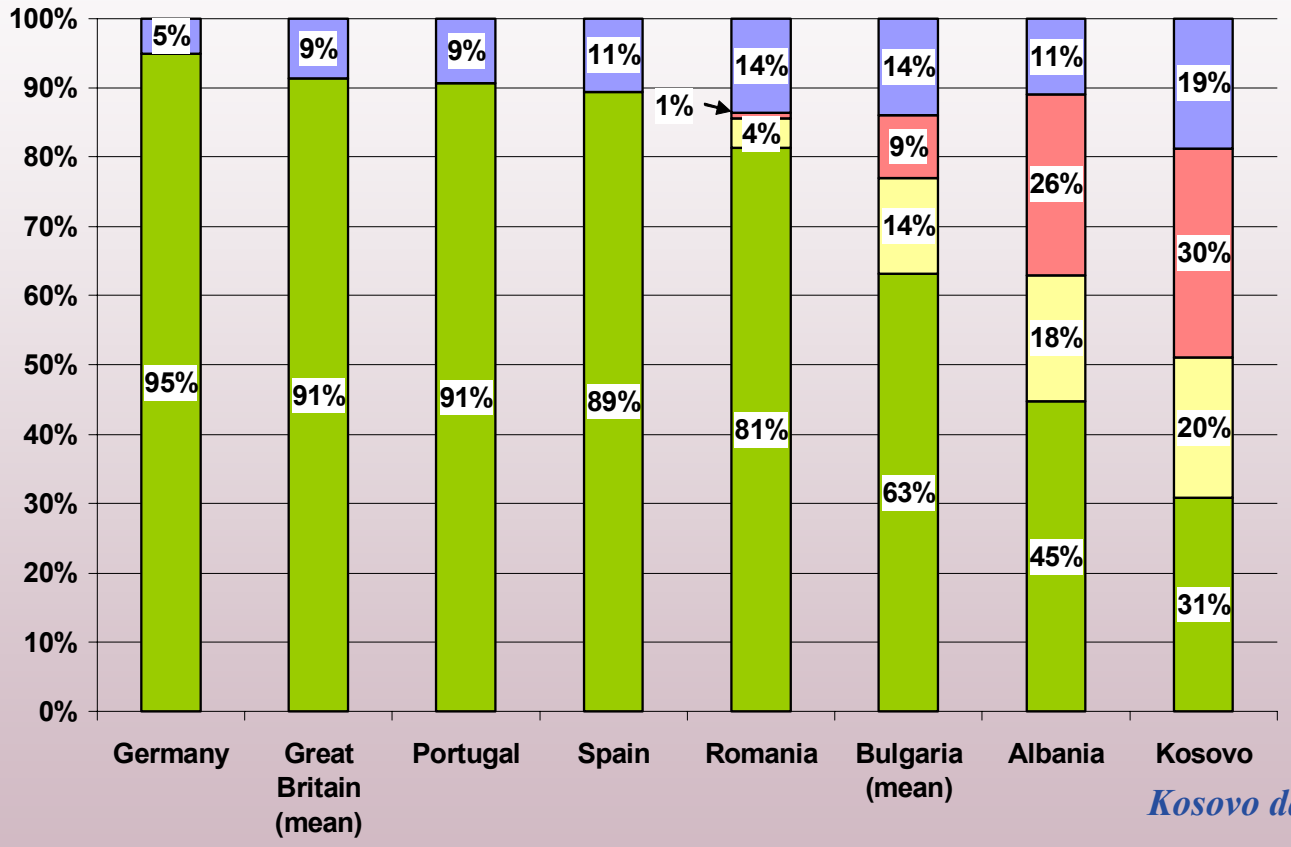
Power Balance for (January-September) 2005



ERO

www.ero-ks.org

Collection and recovery rates compared



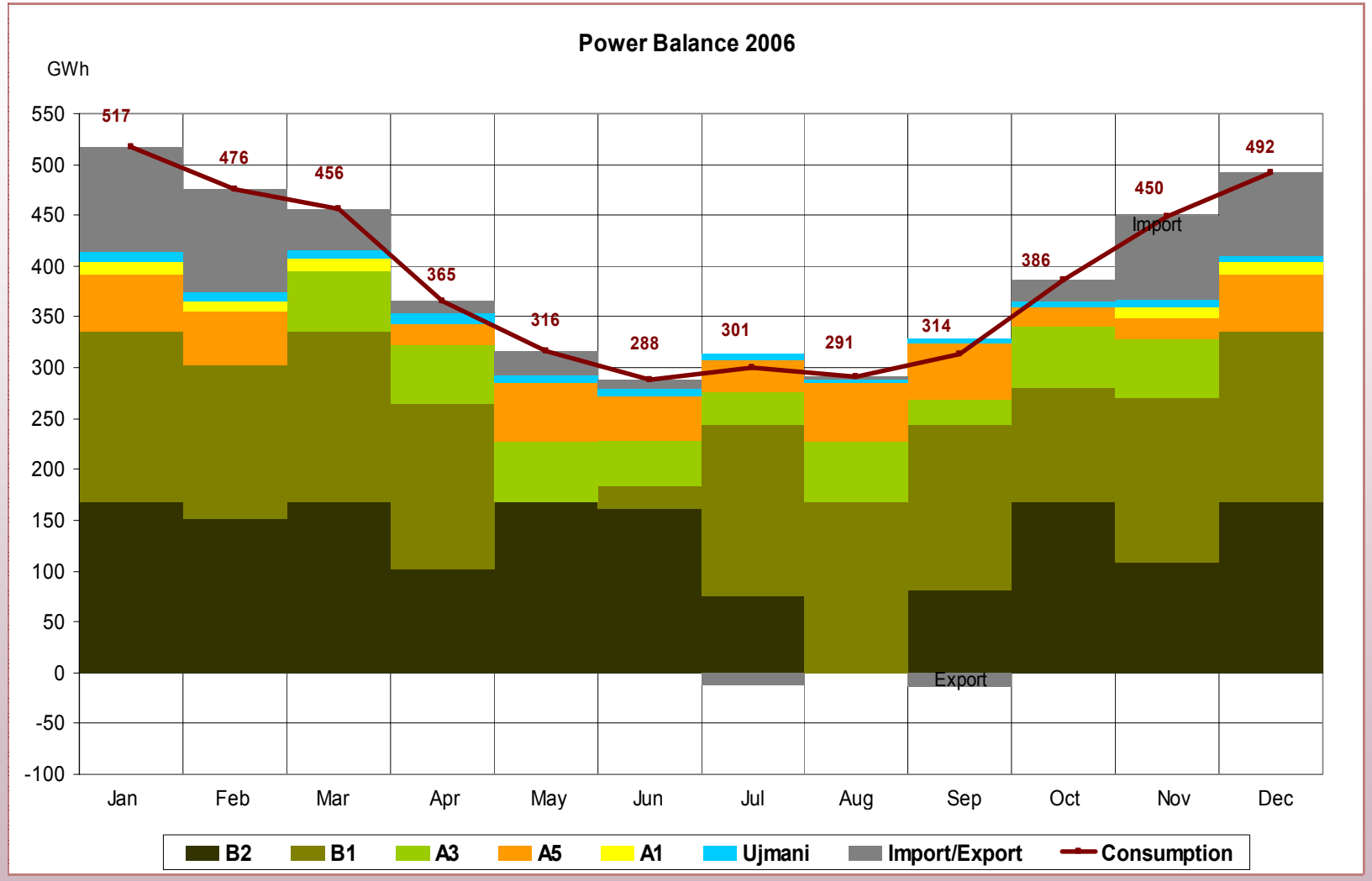
Commercial and collection losses in EU countries are negligible, and included in total T&D losses

Kosovo data for Jan-Jun 2004

ERO

www.ero-ks.org

Forecasted Draft Power Balance for 2006



ERO

www.ero-ks.org

Interconnections

400 kV Interconnection Line Project [€]	Kosovo	Albania	Total
400 kV Substation Bay Cost air-insulated	330 000	330 000	660 000
First section of 400 kV line Kosovo B - Albanian border (85.5 km)	17 111 218	X	17 111 218
Second section of 400 kV line Albanian border - Vau Dejes (75.5 km)	X	15 109 906	15 109 906
Third section of 400 kV line Vau Dejes - Kashar (78 km)	X	6 418 230	6 418 230
Total (239 km)	17 441 218	21 858 136	39 299 354

** 2 conductors per phase*

Interconnection	400 kV	220 kV	110 kV
Kosova Albania	Planned	1 line	
Kosova Macedonia	1 line	2 line out of operation	1 line out of operation
Kosova Montenegro	1 line		
Kosova Serbia	1 line	1 line	2 line

ERO

www.ero-ks.org

District Heating

DH sector in Kosovo is limited only to 4 geographical locations, part of which are covered by 4 companies:

District Heating Company (Town)	Installed capacity	Annual Production 2003/04	Annual Production 2004/05
Units	*[MW]*	*[GWh]*	*[GWh]*
TERMOKOS (Prishtina)	159	96.8	109.6
DHC (Gjakova)	38.6	18.3	14.3
TERMOMIT (Mitrovica)	16.9	N/A	N/A
Total	**214.5**	**115.1**	**123.9**

**** New DH Company "Zvecan" with 1.6 MW installed capacity***

- *heat generation is carried out at the heating plants equipped with fuel oil boilers using heavy oil (mazut)*
- *supplying only 5% of heat demand in Kosovo*
- *it is used exclusively for space heating*
- *does <u>not</u> include supply of hot tap water, so heat enterprises operate only during heating season (15 October - 15 April) - with night-stops*

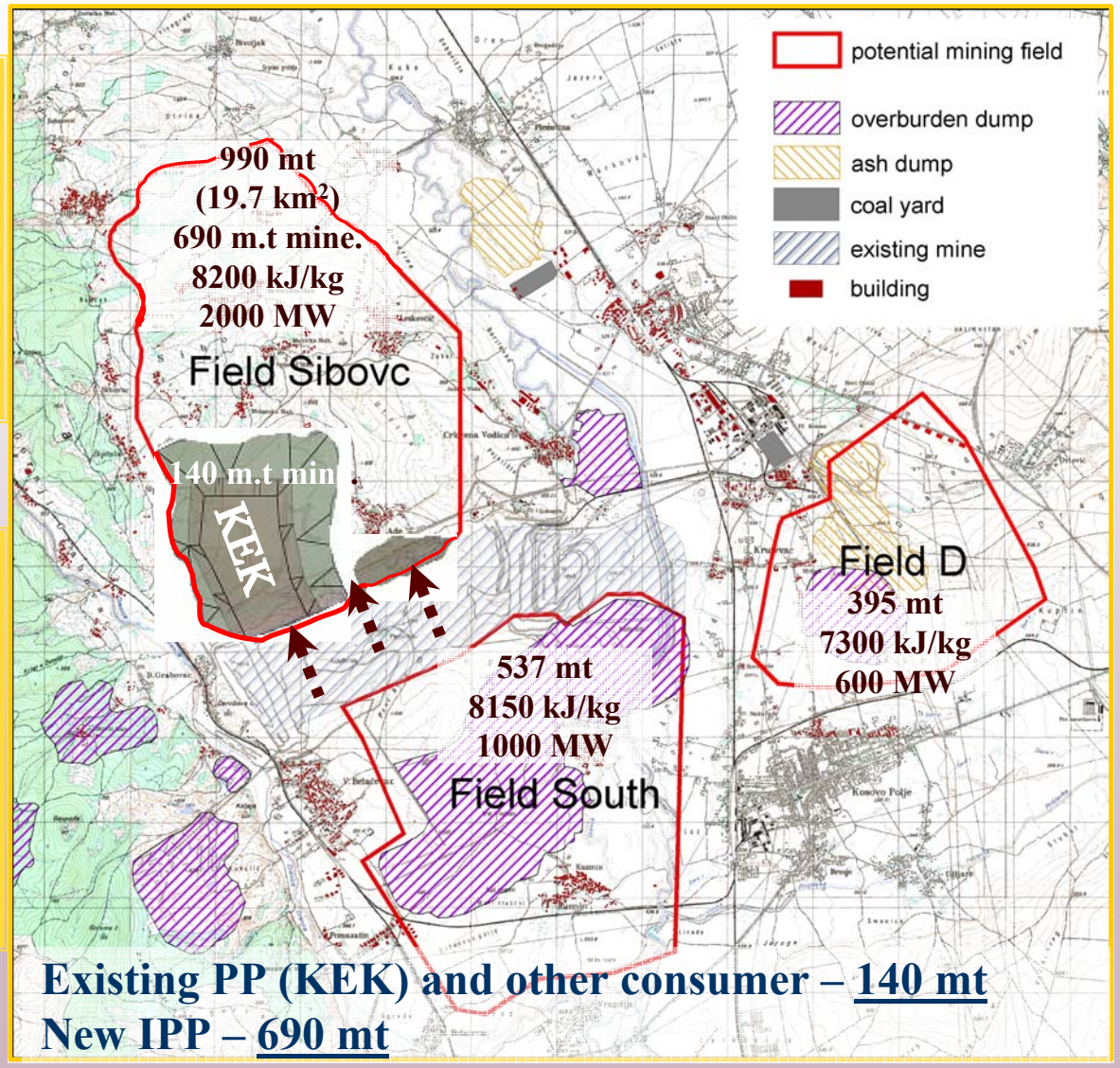
Potential Mines – chosen variant

new mine - which start from the existing mines Mirash/Bardh and advances in Northern direction of the Sibovc field

For illustration:

2000 MW

- 7500 h/a
  = 15 TWh
- 1.1 t/MWh
  = 16.5 mt/a
- 690 mt
  >> 41.8 years



Coal Demand

Designation	Unit	2012	2015	2016	2020	2025
TPP A (3,4,5)	MW	480	480	350	0	0
TPP B (1, 2)	MW	580	580	580	580	580
New IPP (opt. 1)	**MW**	**300**	**900**	**1 500**	**2 100**	**2 100**
Total	MW	1 360	1 960	2 430	2 680	2 680
Generation	TWh	9,45	13,95	13,24	19,93	19,93
Specific Cons.	t/MWh	1,5	1,4	1,4	1,2	1,2
Coal Demand	**mt**	**14,44**	**19,39**	**18,03**	**24,01**	**24,01**

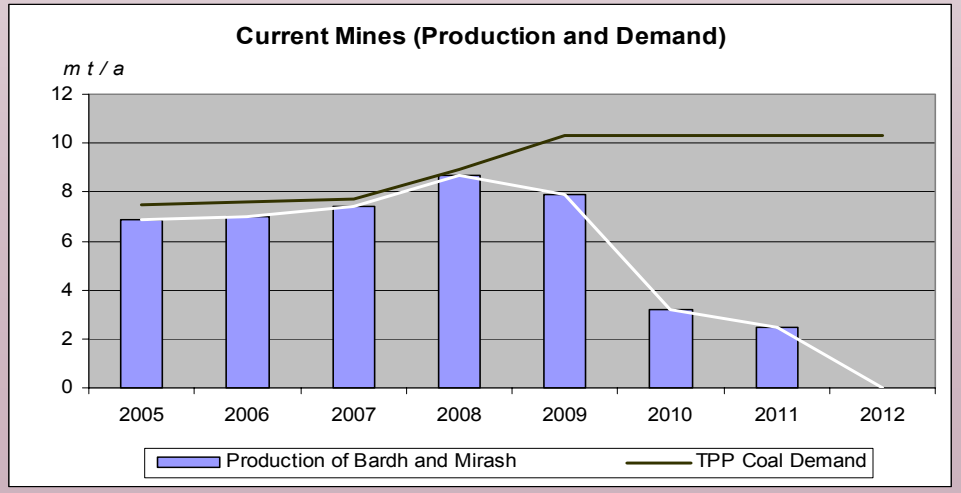
First Option

New IPP 2100 MW
693 mt (2012 – 2057)
Average: 15.06 mt/a

Designation	Unit	2012	2015	2016	2017	2025	2026
TPP A (3,4,5)	MW	480	480	350	350	0	0
TPP B (1, 2)	MW	580	580	580	580	580	0
New IPP (opt. 2)	**MW**	**500**	**1 000**	**1 500**	**2 000**	**2 000**	**2 000**
Total	MW	1 560	2 060	2 430	2 930	2 580	2 000
Generation	TWh	10,95	14,70	17,74	21,49	19,18	15,00
Specific Cons.	t/MWh	1,5	1,4	1,3	1,3	1,3	1,1
Coal Demand	**mt**	**16,09**	**20,22**	**22,98**	**27,11**	**25,20**	**16,50**

Second Option

New IPP 2000 MW
670 mt (2012 – 2057)
Average: 14.8 mt/a



Existing TPP 1060 MW
(Rehabilitated A)
126.5mt (2012 – 2020)
Average: 9.03 mt/a

ERO
www.ero-ks.org

Lignite Mines

- two lignite mines currently in operation (Bardh and Mirash)
- annual production (2004) – 5.76 mil tons
- annual consumption (2004) – 5.71 mil tons, for generating 3.4 TWh
- existing mines will be completely exhausted by 2011 (deficit 2009)
- new lignite field (Sibovc - 1 billion tons)

Lignite Quality of Kosovo	Heating Value	Calorific Value	Ash Content	Moisture Content	Sulphure Content	
Area	*kJ/kg*	*kcal/kg*	*%*	*%*	*% total*	*% comb.*
Sibovc	8 149	1 980	13,9	47,8	0,91	0,32
Bardh	7 860	1 877	14,1	47,7	0,98	0,34
Mirash West	7 750	1 851	14,4	47,5	1,01	0,35
Mirash East	7 928	1 894	19,9	43,9	0,94	0,33

Comparison of coal quality	Kosovo Sibovc	Bulgaria	Poland	Turkey	Germany
kcal/kg	1 980	1 601	1 863	1 051	2 126
Ash (%)	14	2	5	18	5
Sulphur (%)	0.9	0	0.3	1.7	0.3

Main Mining Plan - Sibovc

Capital Expenditures - Sibovc

- Approx. **370 m€** - equipment
- **60 m€** - resettlement

Coal Production

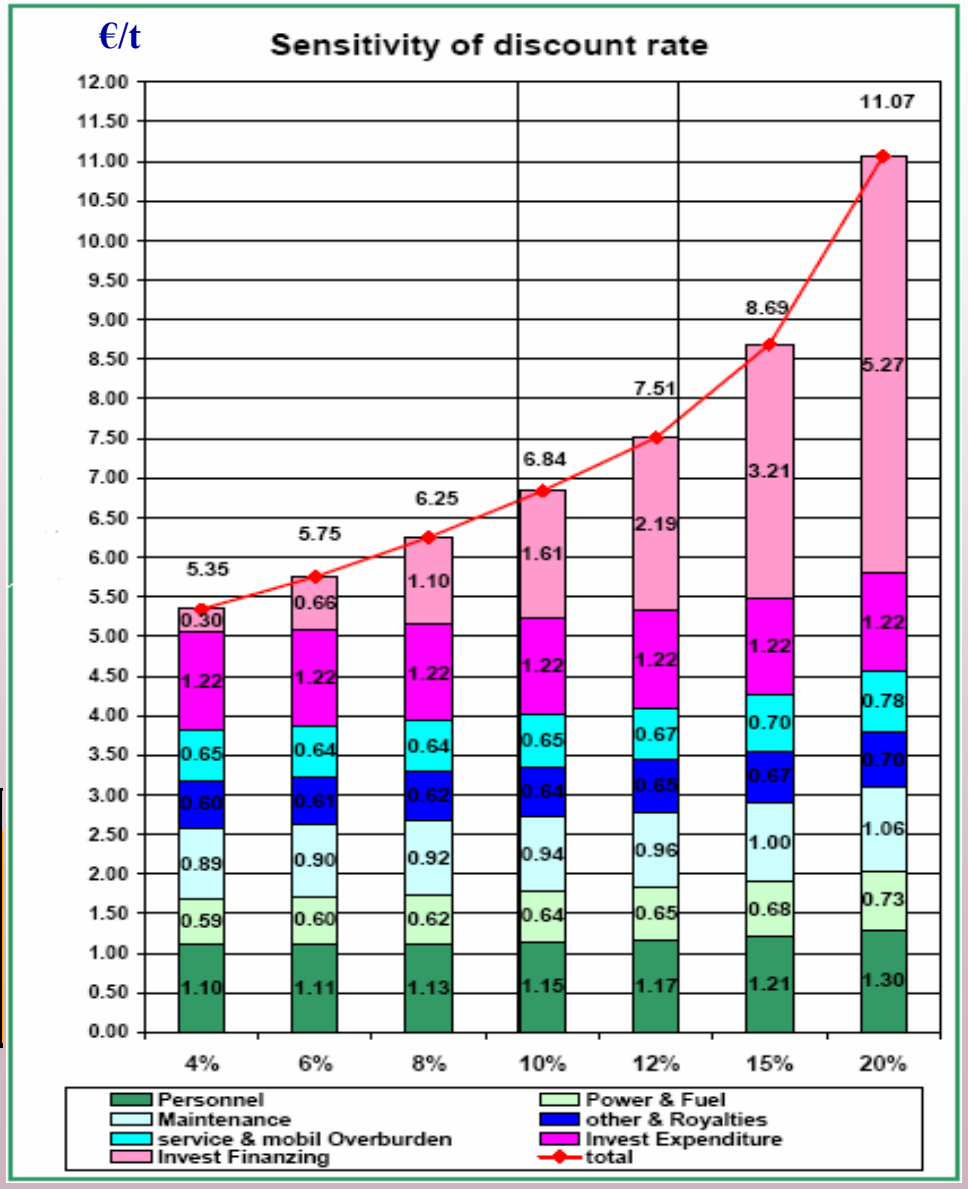
- **16 mt/year**
- from 2019 - **22 mt/year**

Cost of Coal

- **€ 6.84/ton** at 10% IRR
- **€ 7.51/ton** at 12% IRR
- **€ 8.69/ton** at 15% IRR

Assumed WACC 15 %

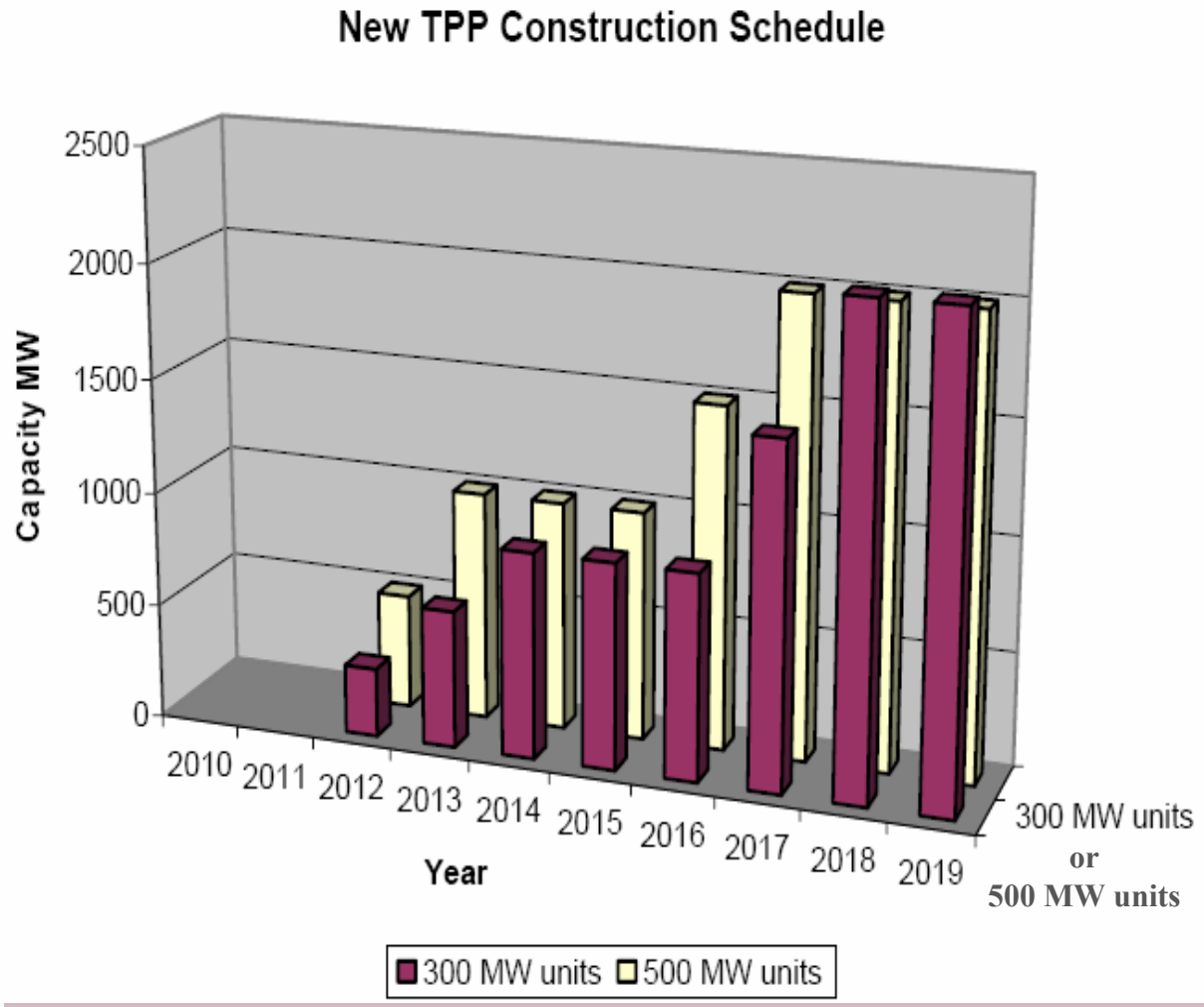
Country - IRR Comparisons	IRR (nominal)
Egypt	**15%-18%**
Kenya	**15%**
Malaysia (1st wave IPPs)	**18%-25%**
Malaysia (2nd wave IPPs)	**12% (target)**
Philippines	**17,50%**



ERO

www.ero-ks.org

New IPP (a)



- **report on evaluation of sites**
  - four potential sites to accommodate the new 2000 MW PP utilizing the Sibovc lignite:
  - A - north at Kosovo B power plant – cost to relocate the existing ash but other onditions are favorable
  - B - north-eastern corner of the Sibovc field in Bivolak – cost comparison favours this option
  - C - north of Grabovc on the western side of the Sibovc field - long term solution
  - D - west of Palaj and the ignite conveyor to Kosovo B - rejected due to risk of having toxic soils and partly by a risk being too close to the mine edges

- **report on background review/ market assessment**
  - estimated variable cost for Kosovo A units is € 14 /MWh and for Kosovo B units €13/MWh
  - 2011- commissioning of the new TPP (first unit 300 MW or 500 MW)

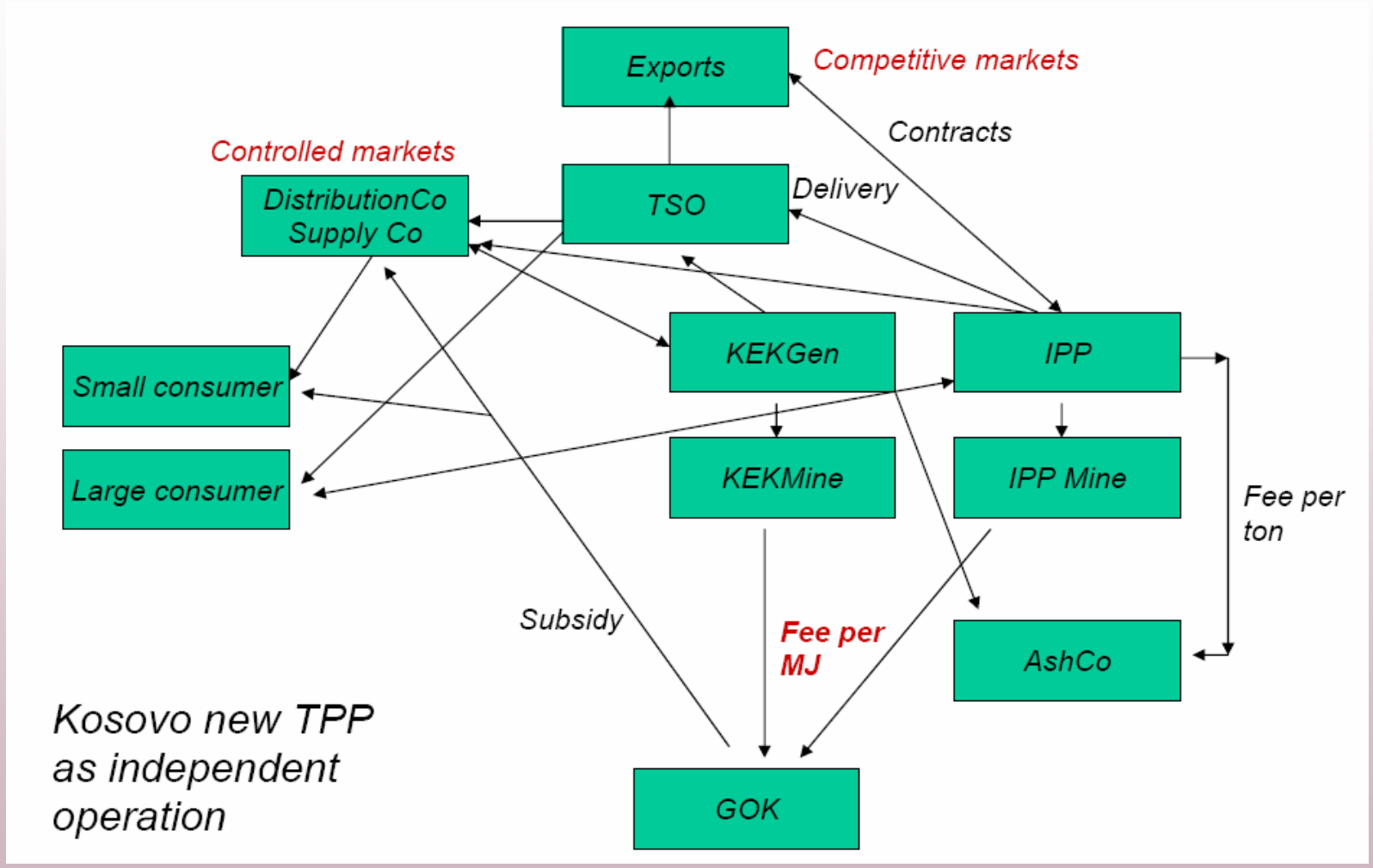
New IPP (b)

- **report on technology evaluation**
  - conventional steam cycles applying: pulverized firing (PF) or circulating fluidized bed (CFB) firing
  - is expected efficiency that would be able meet the € 17 /MWh variable costs

Costs of New Lignite PP	*Unit*	Sub-critical	Sub-critical CFBC	Super-critical PF	Super-critical PF
Capacity	*MW*	300	300	300	500
CAPEX	*€/kW*	1 013	1 080	1 180	1 072
Availibility	*h/a*	7 358	7 446	7 358	7 096
MOR	*%*	11,0%	5,0%	11,0%	13,0%
FOR	*%*	5,0%	10,0%	5,0%	6,0%
Self cons.	*%*	10,0%	10,0%	10,0%	9,0%
Lifetime	*years*	40	40	40	40
Efficiency	*%*	33,5%	36,0%	37,5%	39,0%
Variable O&M	*€/MWh*	1,30	1,00	1,70	1,70
Fixed O&M	*€/MW*	34,00	34,30	36,00	29,60
Lignite cons.	*t/MWh*	1,28	1,15	1,19	1,13
Lignite costs	*€/t*	8,00	8,00	8,00	8,00
IRR	*%*	12.00% 15.00%	12.00% 15.00%	12.00% 15.00%	12.00% 15.00%
Price*	*€/MWh*	35.5 41.0	35.2 41.0	38.0 45.0	36.5 42.6

Price is depending on rate of return that investors will apply*

New IPP (c)


Exports
Competitive markets
Contracts
Controlled markets
DistributionCo
Supply Co
TSO
Delivery
Small consumer
KEKGen
IPP
Large consumer
KEKMine
IPP Mine
Fee per
ton
Subsidy
Fee per
MJ
AshCo
GOK
Kosovo new TPP
as independent
operation

ToR for Kosova A rehabilitation options

Capacities

Current situation of Kosovo A units:

- poorly maintained and poor availability
- largest polluter in Kosovo and is not in compliance with the EU environmental standards

Capital Rehabilitation in €	A4	A5
Steam Generator		
Structure	607 250	607 250
Heat Exchanger	7 177 300	7 177 300
Boiler	566 100	566 100
Other Pipes	8 848 650	8 848 650
Fuel System		
Coal System	1 150 050	1 150 050
Fuel Oil System	41 100	41 100
Combustion Air	351 020	351 020
Flue Gas	2 725 000	2 725 000
Ash Handling	4 267 170	4 267 170
Construction Works	16 176 241	16 176 241
Turbo-Generator	6 875 000	7 125 000
Balance of Plant and Condensator	6 050 000	6 050 000
Cooling Tower	1 500 000	1 500 000
Electricity	3 800	3 500
Control and Instrumentation	4 700	4 700
Subtotal	56 343 381	56 593 081
Contingency: 10 %	5 634 338	5 659 308
Total	**61 977 719**	**62 252 389**

Kosova A rehabilitation costs

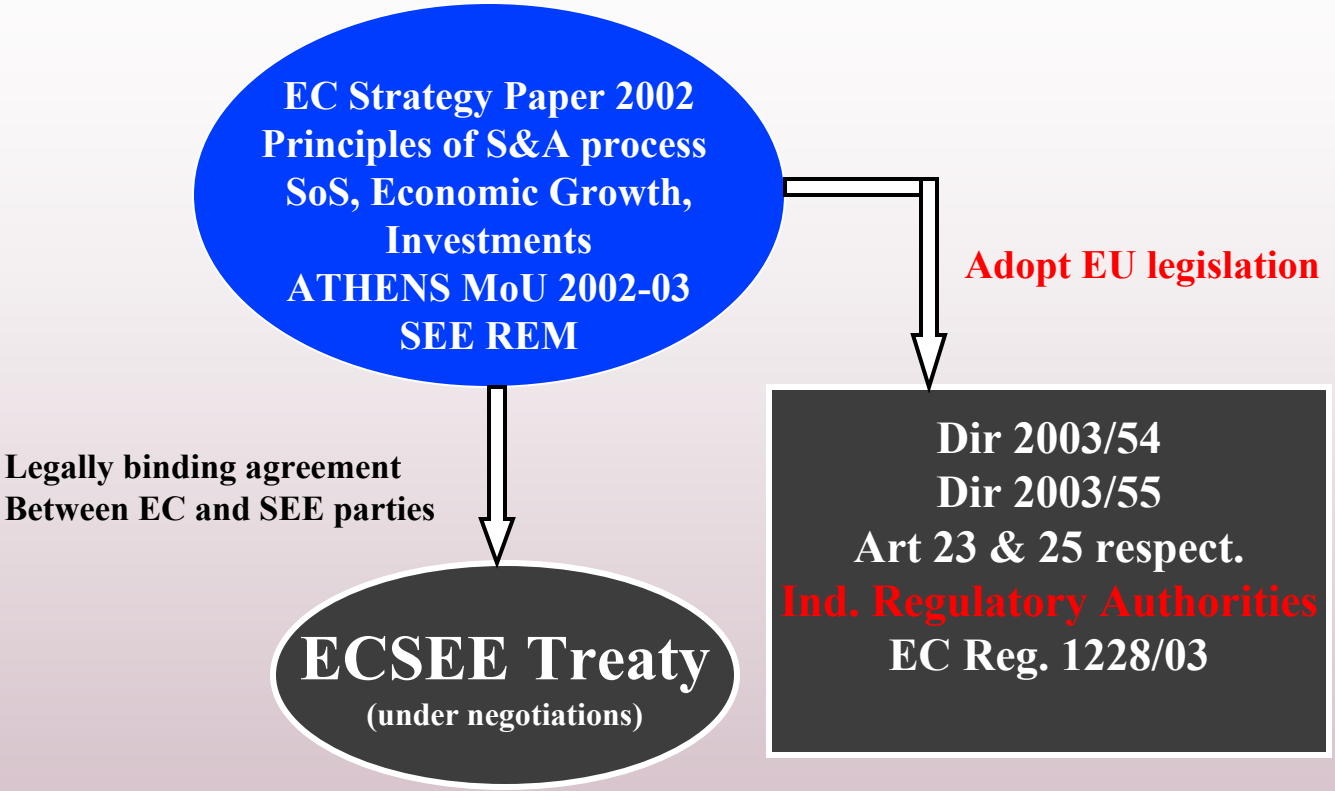
- Feasibility Study estimated that more than **€ 60 million** would be required for rehabilitation of each unit A4 and A5

Costs of New Lignite PP	*Unit*	A1	A3	A4	A5	A4 and A5 other studies
Capacity [net]	*MW*	35	110	150	155	360
CAPEX	*m€*	10	24	62	62	212
Availibility	*h/a*	5 000	5 500	6 600	6 600	7 000
MOR	*%*	25,0%	24,9%	16,7%	16,7%	20,0%
FOR	*%*	18,0%	12,3%	8,0%	8,0%	-
Lifetime	*years*	4	4	12	12	15
O&M	*m€/year*	2,0	3,0	2,0	2,0	4,8
Lignite costs	*€/t*	8,00	8,00	8,00	8,00	8,00
Lignite consum.	*t/MWh*	2,1	1,90	1,7	1,7	1,5
Oil consum.	*kg/MWh*	10,72	5,88	2,55	2,55	-
IRR	*%*	12.00% 15.00%	12.00% 15.00%	12.00% 15.00%	12.00% 15.00%	12.00% 15.00%
Price*	*€/MWh*			31.2 33.0	29.1 31.9	33.5 36.0

Price is depending on rate of return that investors will apply*

ERO
www.ero-ks.org

Kosovo Regulatory Framework



Statutory Powers of ERO

- **Issue Secondary Legislation** (Rules, Codes, Decrees, Ordinances, Guidelines)

- **Set the Criteria and Issue Licenses** for Energy Enterprises (exemptions)

- **Approve Tariffs on Public Services Activities** (non Market-based). Regulated Prices based on "ex-ante" Methodology issued by ERO and Tariffs approved by ERO.

- ERO Approves PPAs for PS.

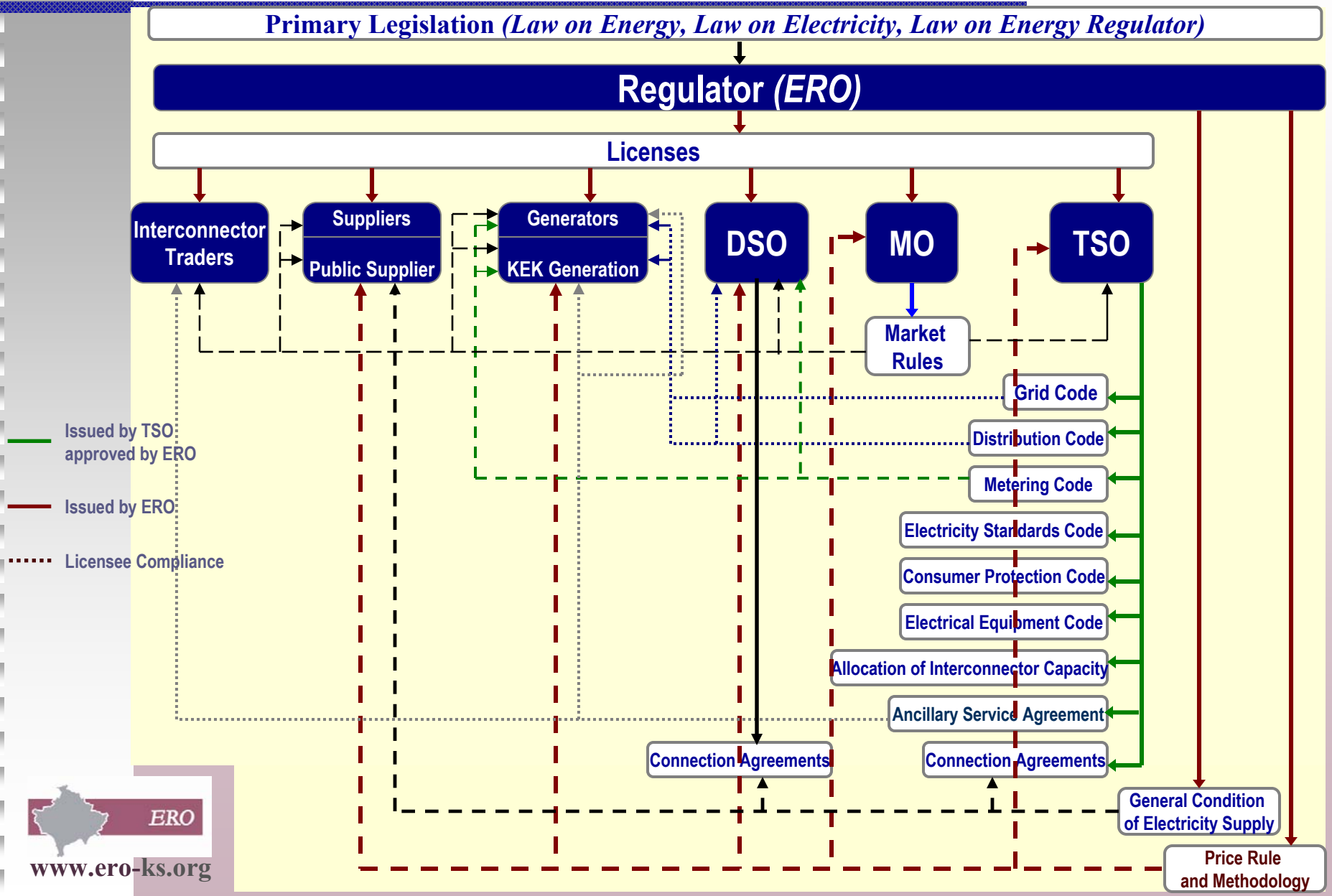
- Grants **Permits** for Construction of new Capacity, Lines and Pipelines and Direct Lines. Grants its consent for the merging, reduction in capital and/or divestments of assets of energy enterprises

- Issues **"Certificates of Origin"** for RES – Approves **"compensation cost"** of PSO. Recovery of **"Stranded Costs"** determined and approved by ERO

- Resolution of **Disputes** between Customers/Licensees, Arbitration Procedures

- Approves Grid/Distribution/Metering/Market/etc. **Codes**

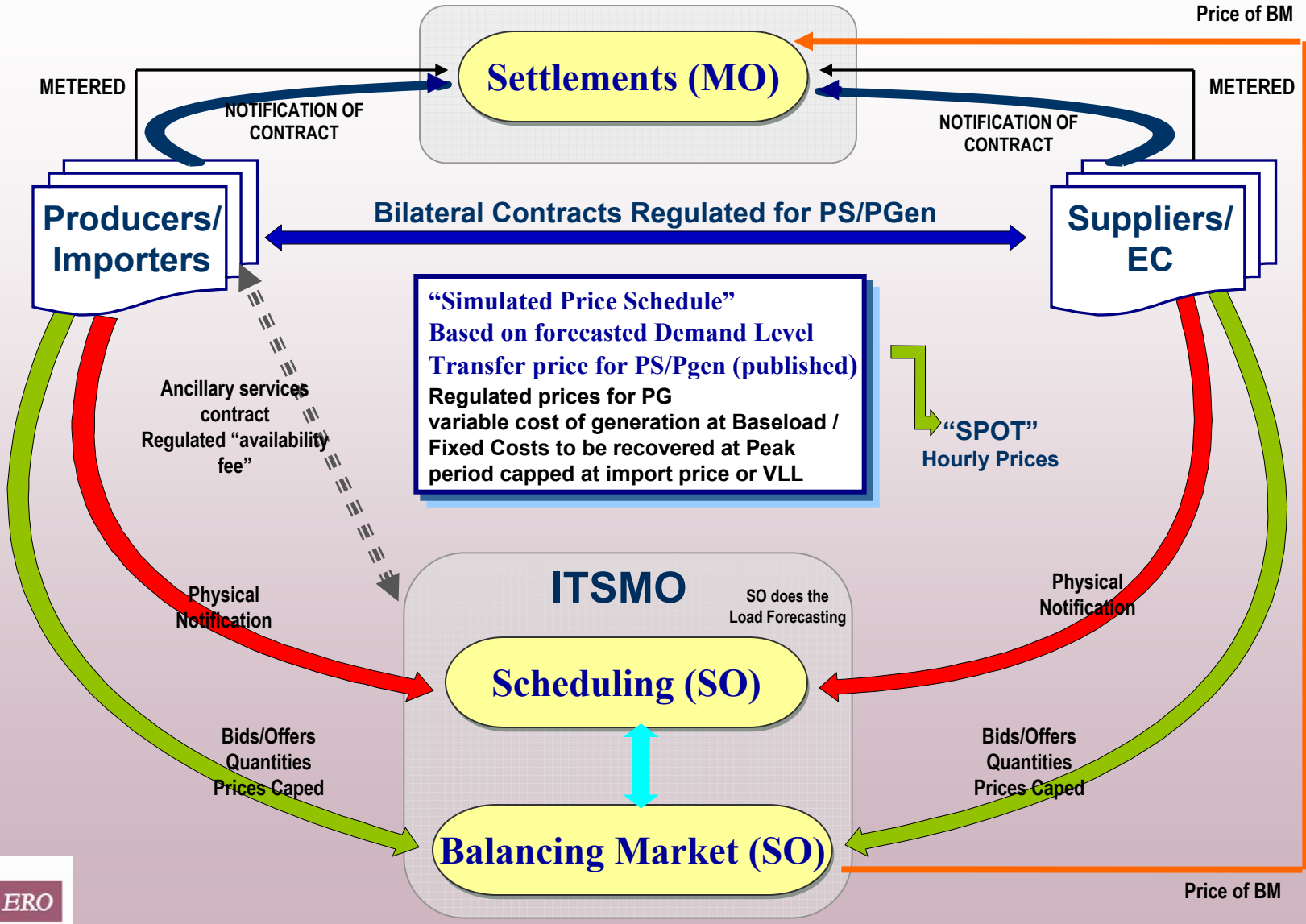
Legal Framework



ERO

www.ero-ks.org

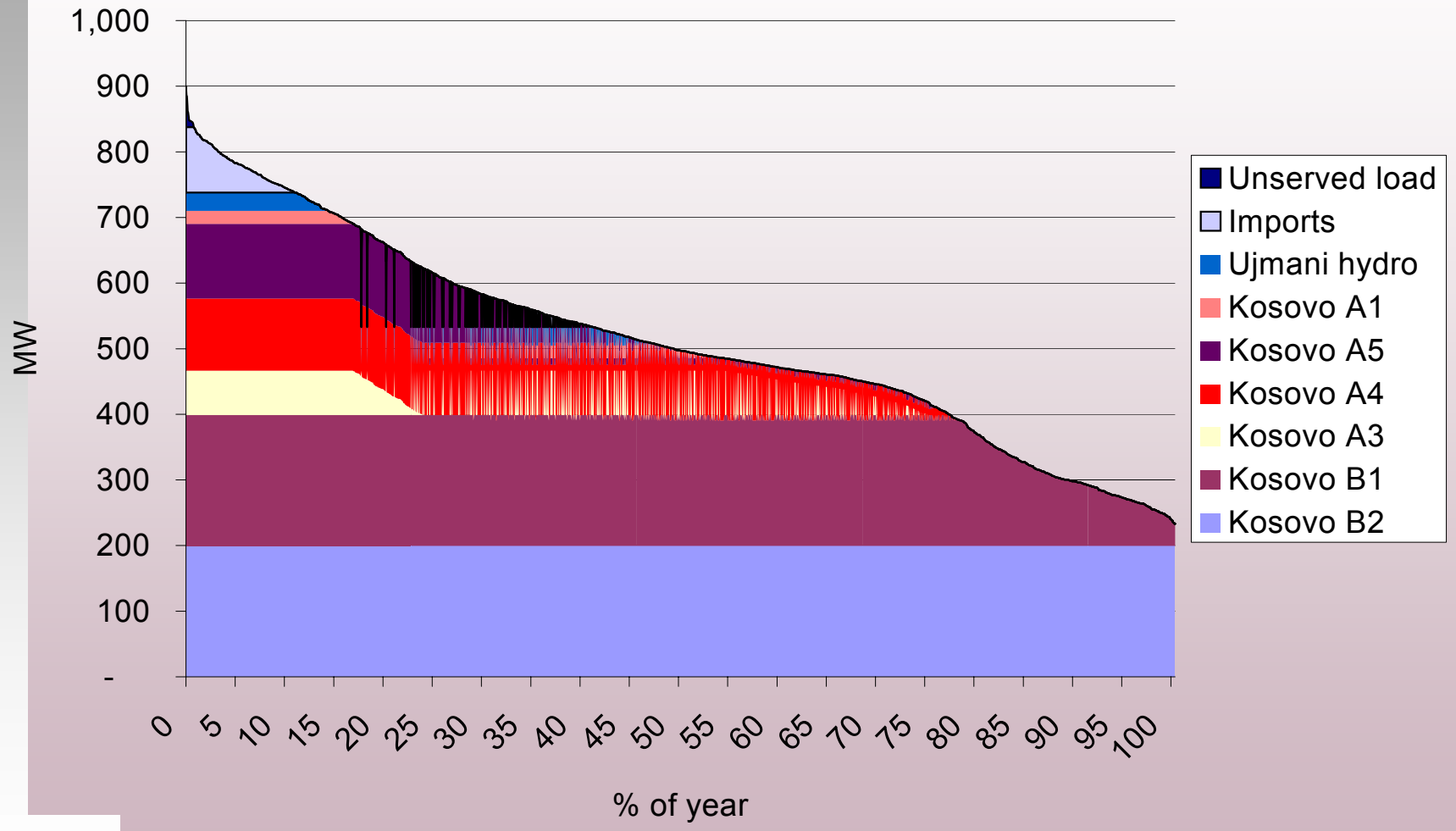
Market Design - Net Pool



ERO

www.ero-ks.org

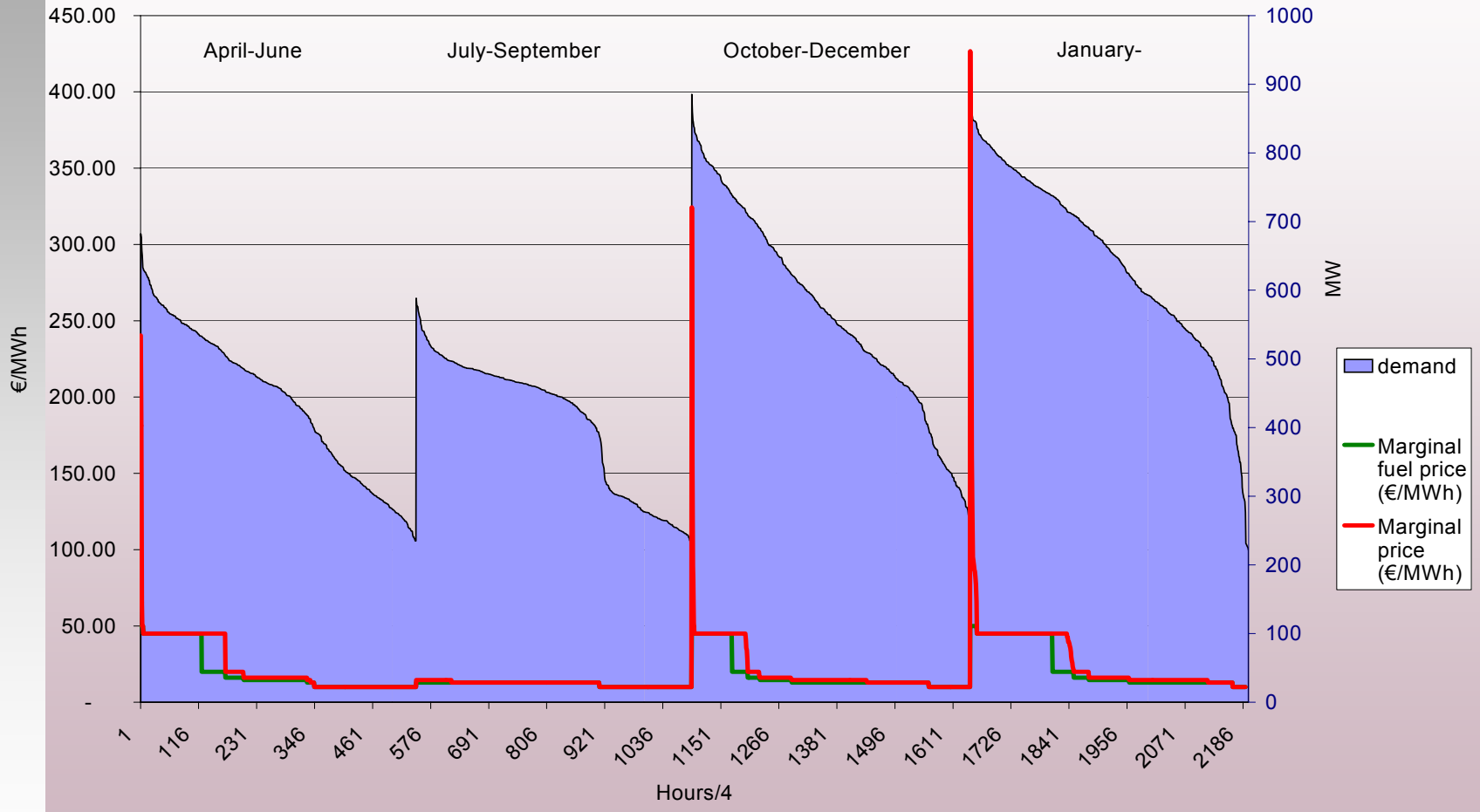
Load duration curve and merit-order dispatch



ERO

www.ero-ks.org

Seasonal load and price curves



Simulated Market Price formula

In any Settlement Period **"*j*", the** Simulated Market Price **(MP_{sj}) is derived from the formula:**

$$MP_{sj} = VC_{Ms} + RR_{Msj} * \frac{(DD_{Msj})^2}{CC_{Msj}} * k_M$$

where:

"*s*" is the season in which **Settlement Period** "*j*" falls;

"*M*" is the marginal plant in the merit-order dispatch in **Settlement Period** "*j*";

VC_{Ms} is the variable costs of the marginal plant "*M*" in the season "*s*";

DD_{Msj} is the modelled dispatch of the marginal plant "*M*" in the **Settlement Period** (in MWh);

CC_{Msj} is the available capacity of the marginal plant "*M*" in the **Settlement Period** (in MW);

RR_{Msj} is residual **Required Revenue** (in €) for the remainder of the year of the marginal plant "*M*" in the **Settlement Period** derived from the formula:

$$RR_{Msj} = RR_{Msj-1} - (MP_{sj-1} - VC_{Ms}) * DD_{Msj-1} ;$$

k_M is a scaling factor designed to scale back the contribution to **Required Revenue** of the marginal plant "*M*" in each **Settlement Period** to that of total annual revenue requirement that is derived from the formula:

$$k_M = \sum_{n=1}^{n=8760} \frac{(DD_{Msj})^2}{CC_{Msj}}$$

with "*n*" as each **Settlement Period** in the year to which **Required Revenue** applies;

with the constraints:

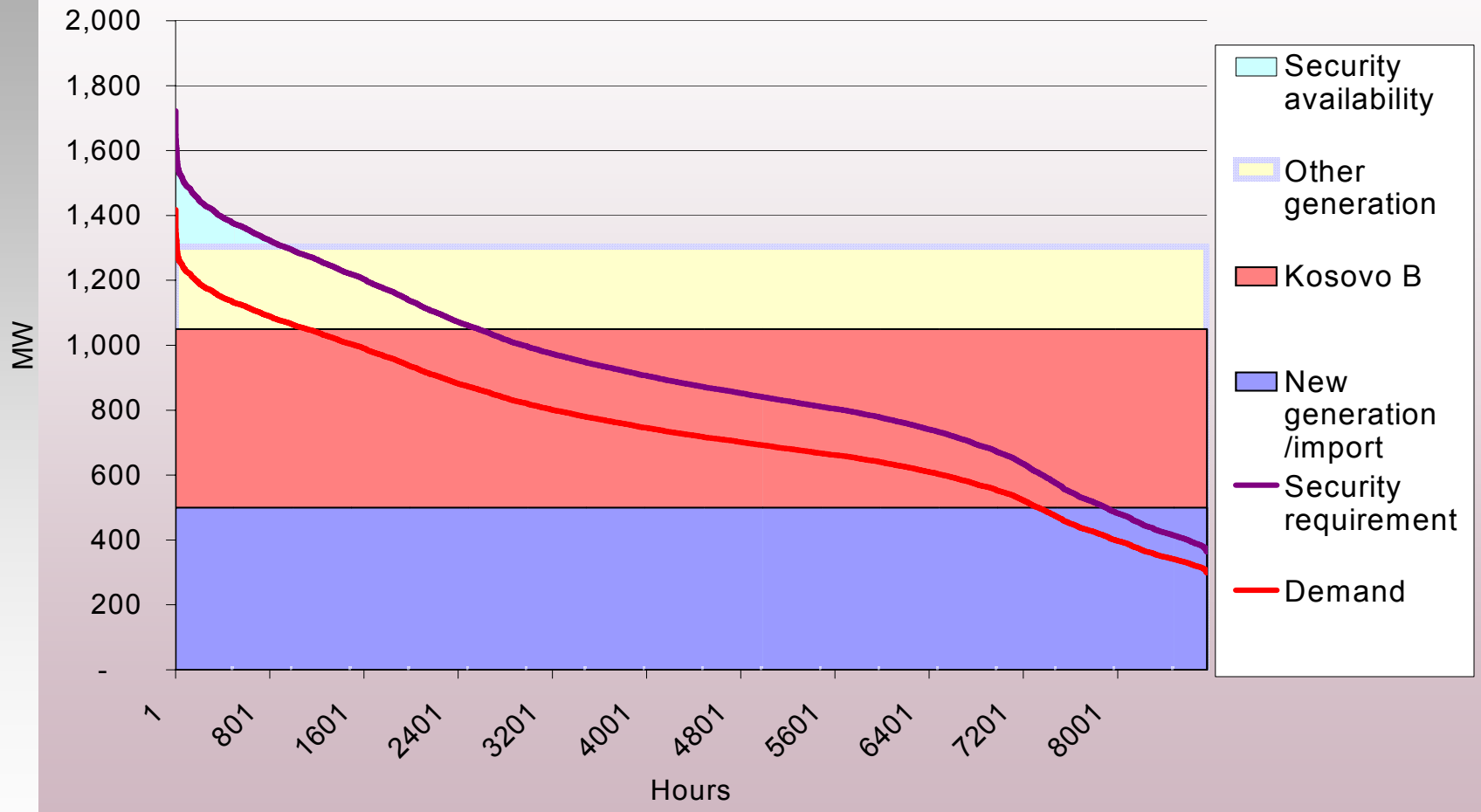
$$MP_{sj} \leq MP_{sj-1}$$

but only where the season "*s*" is the same in both **Settlement Period** "*j*" and **Settlement Period** "*j-1*"; and

$$MP_{sj} \leq VC_{M+1s}$$

where "*M+1*" is the next plant in the merit order stack in ascending order of variable cost.

Security of Supply Model results for 2015



Derivation of Capacity Penalty Reference Price

The Capacity Penalty Reference Price (PCMAX) is derived from the formula:

$$PCMAX = CYTOT * \frac{(MWSEC_{PEAK})^2}{\sum_{n=1}^{n=8760} (MWSEC_n)^2} / MWSEC_{PEAK}$$

where:

CYTOT is the annual fixed costs (in €) of providing sufficient annual capacity to give a security margin that is based on costs of provision on the lowest merit units on the system (possibly Kosovo A4 and A5);

"PEAK" is the Settlement Period "j" of highest forecast demand

MWSECj is Megawatts Security Capacity which is the capacity above Normal Dispatched Capacity (NDC) and below the Capacity Requirement (ATREQj) for Settlement Period "j" which is derived from the formula:

MWSECj = Max (ATREQj – NDC , 0)

where:

ATREQj is derived from the formula:

$$ATREQ_j = ATMN * \sum_a QESU_{aj} / TLF_j$$

where:

"j" is any Settlement Period;

ATMN is the Capacity Margin Requirement (expressed as a ratio of peak demand plus security margin to peak demand);

QESUaj is forecast Supply Unit Metered Demand;

"a" is any demand-side Metering System that is not an Interconnector and is not an Embedded Generator or Auto-producer with Generator Declared Capacity; and

TLFj is the Transmission Loss Factor (TLF) forecast for Settlement Period "j";

NDC is a forecast sum of Generator Declared Capacity excluding capacity assumed for reserve where, for the time being it is assumed that In the forecast year, where capacity is dispatched in merit order, there will be sufficient base load capacity (whether from new generation or net imports) to reduce Kosovo B net operating hours to approximately 4000.

Security of Supply Parameters for 2015

- TLFj is 1.03
- ΣQESUaPEAK /TLF is 1,418 MW
- ATMN is 1.215 (a 21.5% security margin or approximately 300MW)
- NDC is 1,305 MW
- MWSECPEAK is 417 MW
- CYTOT is €15,719,000 (source: EAR Kosovo A Rehabilitation Study)
- PCMAX is €551.05 /MW/hour

Regulated tariffs in the Kosovan electricity industry

	Public Supplier	Other suppliers	TNO	DNO	Non-eligible customers	Eligible customers
Public Genco	PPA		TUOS Connection charge			
IPPs			TUOS Connection charge	DUOS Connection charge		
Public Supplier			TUOS	DUOS	Retail price	
Other Suppliers			TUOS	DUOS		
Non-eligible customers			Connection charge	Connection charge		
Eligible customers			Connection charge	Connection charge		

Ευχαριστώ!

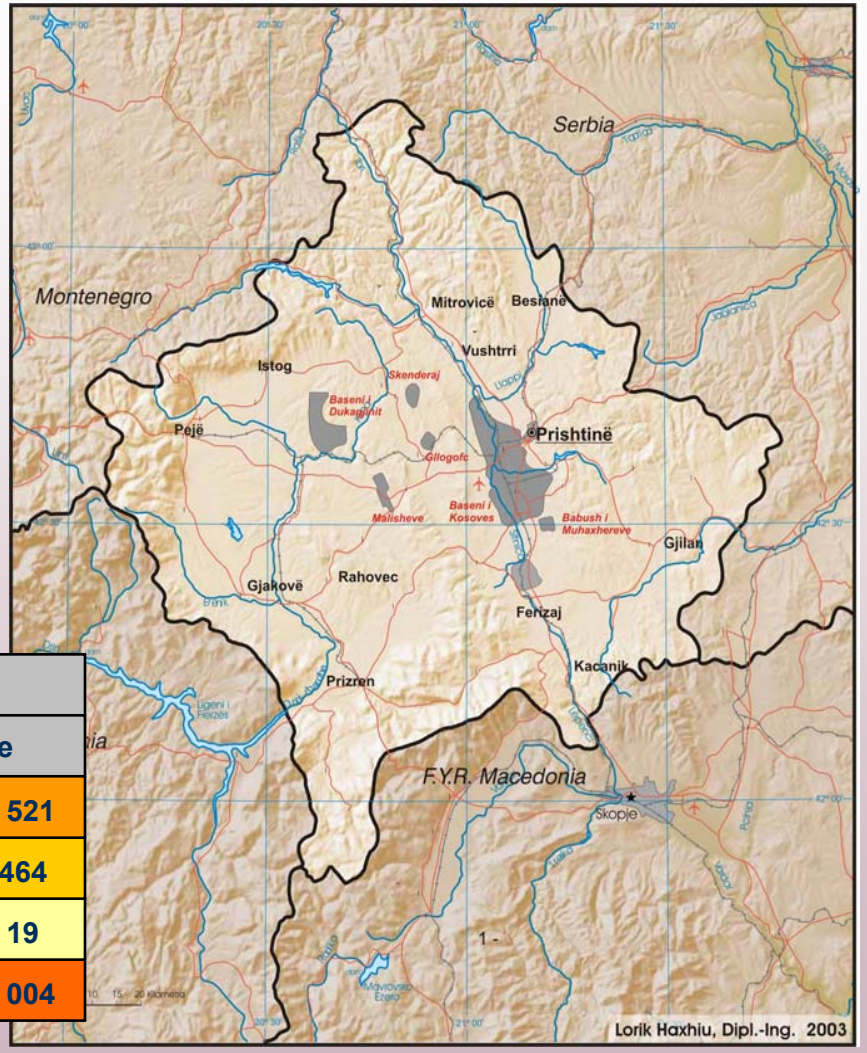
Energy Regulatory Office
Hamdi Mramori Street No
Prishtina – Kosovo (UNMIK)
Tel: +381 (0) 38 247 615 ext. 101
Fax: +381 (0) 38 247 620
e-mail: info@ero-ks.org
www.ero-ks.org

Lignite Reserves

- *Two major lignite basins:*
  - **Kosova** lignite basin, and
  - **Dukagjini** lignite basin

- *Three smaller lignite basins:*
  - **Drenica**
  - **Malishevë**
  - **Babush i Muhaxherëve,** and

potential zones of other lignite basin in western part of Kosovo



Lignite Basin	Area [km2]	Reserves [Million Tonnes]			
		Geological		Exploitable	
Kosova	264	11 500	2 957	9 804	2 521
Dukagjini	95	2 737	782	1 625	464
Other		87	22	74	19
Total		14 324	3 761	11 503	3 004

Existing Mines

Capacities

ERO

www.ero-ks.org