ENERGY REGULATORY COMMISSION
OF THE REPUBLIC OF MACEDONIA

Energy Regulatory Commission of the Republic of Macedonia

Partnership Program
(ERC, Republic of Macedonia - PSB, Vermont)
Vermont, May 23-27, 2005

Branko Brajkovski, Commissioner
Murat Ramadani, Commissioner

ENERGY REGULATORY COMMISSION
OF THE REPUBLIC OF MACEDONIA

Heating, Affordability / Social Safety Nets

(municipal networks, urban heating, residential end-use energy efficiency)

10 BASIC TOPICS

1. **MANNERS OF HEATING IN THE URBAN ENVIRONMENTS IN THE REPUBLIC OF MACEDONIA**
2. **SHARE OF DIFFERENT MANNERS OF HEATING IN THE URBAN ENVIRONMENTS**
3. **USED HOUSEHOLD HEATING FUELS**
4. **COMPARISON OF HEATING FUELS' PRICES IN THE REPUBLIC OF MACEDONIA**
5. **COMPARISON OF HEATING ENERGY PRICES FROM DISTRICT HEATING FOR HOUSEHOLDS IN THE REPUBLIC OF MACEDONIA AND IN THE SURROUNDING REGION**
6. **MUNICIPAL HEATING RELATIONS, REALIZED BY DISTRIC HEATING**
7. **SOCIAL PROTECTION, WITH THE PRICE REGULATION METHOD AND TARIFF SYSTEM FOR TARIFF CUSTOMERS**
8. **DISTRICT HEATING, THE MOST COMMON URBAN HEATING AND ITS TECHNICAL CHARACTERISTICS**
9. **TYPES OF ENERGY GENERATION PLANTS**
10. **TRENDS AND FUEL CONSUMPTION IN EUROPE AND IN THE REPUBLIC OF MACEDONIA UP TO 2020**

TOPICS 1, 2, and 3

Number of households according to the manner of space heating

	Types of space heating						
	Total number of households	Central heating	Own installation heating				
			electricity	coal	wood	liquid fuels	Unknown fuels
	Manner of space heating						
	Total number of households	Central heating	Individual central heating				
			electricity	coal	wood	liquid fuels	unknown fuels
Republic of Macedonia	564.296 100%	46.451 8,23%	7.446 1,32%	696 0,12%	9.001 1,60%	6.265 1,11%	112 0,02%
Skopje	137.367	44.163	4.599	151	2.099	2.324	25
Bitola	26.387	2.219	334	211	482	714	5
Makedonska Kamenica	2.437	31	2	-	54	2	-

Topic 1, 2, and 3 (CONTINUED)

Number of households according to the manner of space heating

	Manner of space heating							
	Total number of stove-heated households	Stove heating						Other types of heating
		electricity	coal	wood	liquid fuels	gas	unknown fuels	
	Manner of space heating							
	Total number of stove-heated households	heating by stove						Other types of heating
		electricity	coal	wood	liquid fuels	gas	unknown fuels	
Republic of Macedonia	**493.986** 87,54%	**84.272** 14,93%	**486** 0,09%	**406.556** 72,05%	**2.231** 0,40%	**163** 0,03%	**278** 0,05%	**339** 0,06%
Skopje	**83.872**	**35.658**	**84**	**47.123**	**881**	**74**	**52**	**134**
Bitola	**22.406**	**7.870**	**78**	**14.319**	**104**	**17**	**18**	**16**
Makedonska Kamenica	**2.348**	**27**	**1**	**2.316**	**3**	**-**	**1**	**-**

TOPIC 4

COMPARISON OF THE HEATING PRICES IN THE REPUBLIC OF MACEDONIA

depending on the fuel used, and derived at 1kWh

Number	Energy type	PRICE c€ / kWh	Ratio of heating energy prices depending on the type of fuel used
1.	District heating energy price	2,65	1,00
2.	Wood heating energy price	3,10	1,17
3.	Coal heating energy price	3,29	1,24
4.	Average price of household electricity	3,73	1,40
5.	Extra light oil heating energy price	5,23	1,97

TOPIC 5

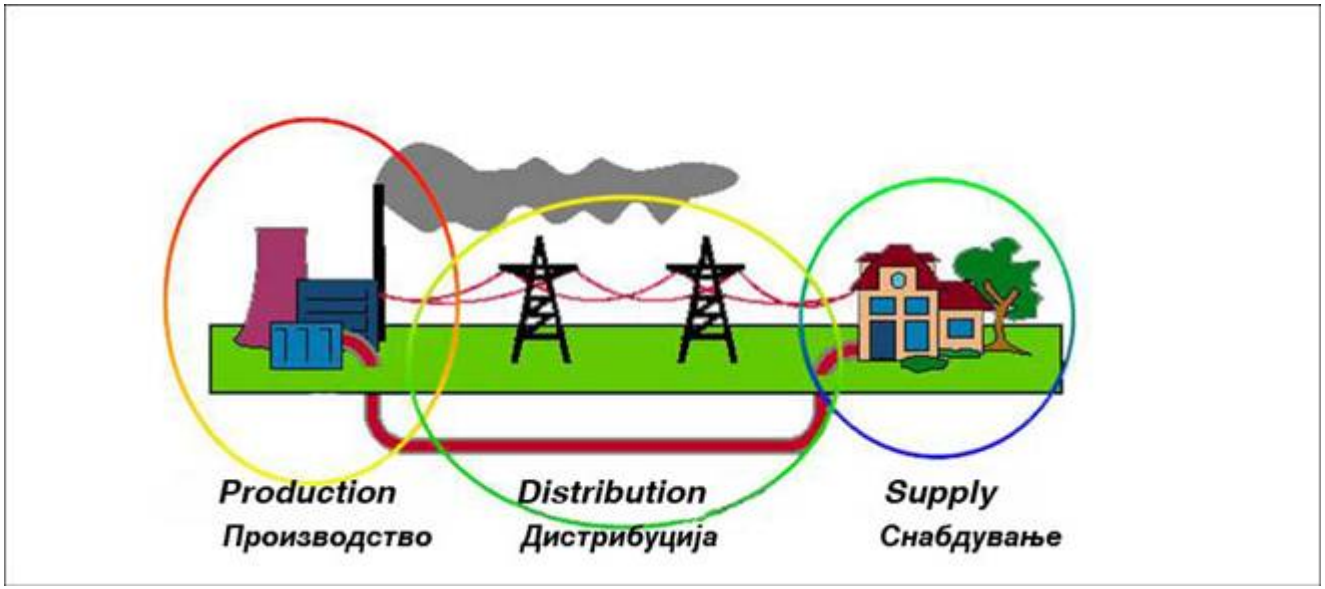
COMPARISON OF THE HEATING ENERGY PRICES FROM DISTRICT HEATING OF HOUSEHOLDS IN THE REPUBLIC OF MACEDONIA AND IN THE REGION

	Heating energy price (flat rate for 1m$^{2)}$	Heating energy price weighted by meters	Installed capacity price
Cities	€ / m^2 / month	€ / MWh	€ / MW / month
Skopje	0,380	24,58	1.231
Belgrade, Serbia	0,337	/	/
Zagreb, Croatia	0,337	15,15	1.105
Ljubljana, Slovenia	none	23,13	548
Sofia, Bulgaria	none	22	435

TOPIC 6

DEPENDENCE IN DISTRICT HEATING

- PRODUCTION
- DISTRIBUTION
- SUPPLY



SHOULD NOT BE INTERRUPTED !!!

TOPIC 6 (CONTINUED)

DISTRICT HEATING IN THE REPUBLIC OF MACEDONIA

1. **Broader area of the city of Skopje – serviced by "Toplifikacija" AD Skopje**
2. **North part of the city of Skopje – serviced by "Skopje – Sever" AD Skopje**
3. **Industrial zone of the city of Skopje – serviced by "Energy Sector –ESM" Skopje**
4. **Public heating enterprise of the city of Makedonska Kamenica – serviced by "Doming"**
5. **Residential area of the city of Bitola – serviced by "Toplifikacija-Bitola" DOO**

TOPIC 6 (CONTINUED)

TECHNICAL CHARACTERISTICS OF THE EXISTING DISTRICT HEATING IN THE REPUBLIC OF MACEDONIA

DISTRICT HEATING	Installed capacity of district heating plants in MW	Network's length in km	Installed capacity of the consumer in MW	Heating area in m^2
''TOPLIFIKACIJA'' AD Skopje, 1965.	518	177,5	612	4.000.000
''SKOPJE -SEVER '' AD Skopje, 2000	46	8,5	30	220.416
''ENERGY SECTOR - ESM'' Skopje, 1997	32	11,0	21	155.000
Total for the city of SKOPJE	615	197	663	4.375.416
"TOPLIFIKACIJA BITOLA " DOO, 1999	26	9,5	20	125.000
PE "Doming" M. KAMENICA, 1990	12	5,0	6	2.325

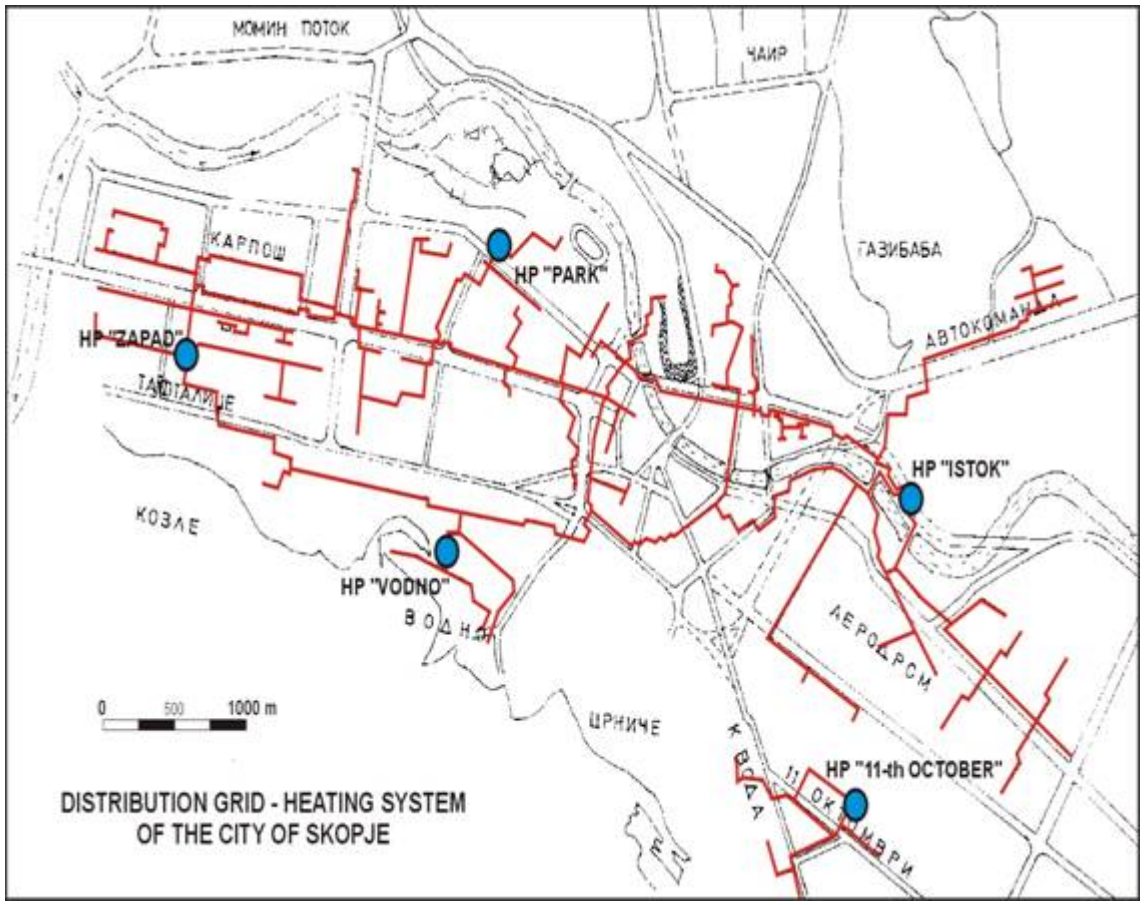
TOPIC 6 (CONTINUED)

TOPLIFIKACIJA AD SKOPJE

- **Number of heating plants: 5**
- **Installed capacity: ~ 518 MW**
- **Number of consumers: ~ 612 MW**
- **Annual fuel needs: ~ 70,000 $t_{equ,}$**
  - **Crude oil: ~ 75 %**
  - **Natural gas: ~ 25 %**
- **Produced heating energy: ~ 700 GWh**
- **Consumption of electricity: ~ 19 GWh**

TOPIC 6 (CONTINUED)

DISTRIBUTION GRID SERVED BY AD "TOPLIFIKACIJA"- SKOPJE



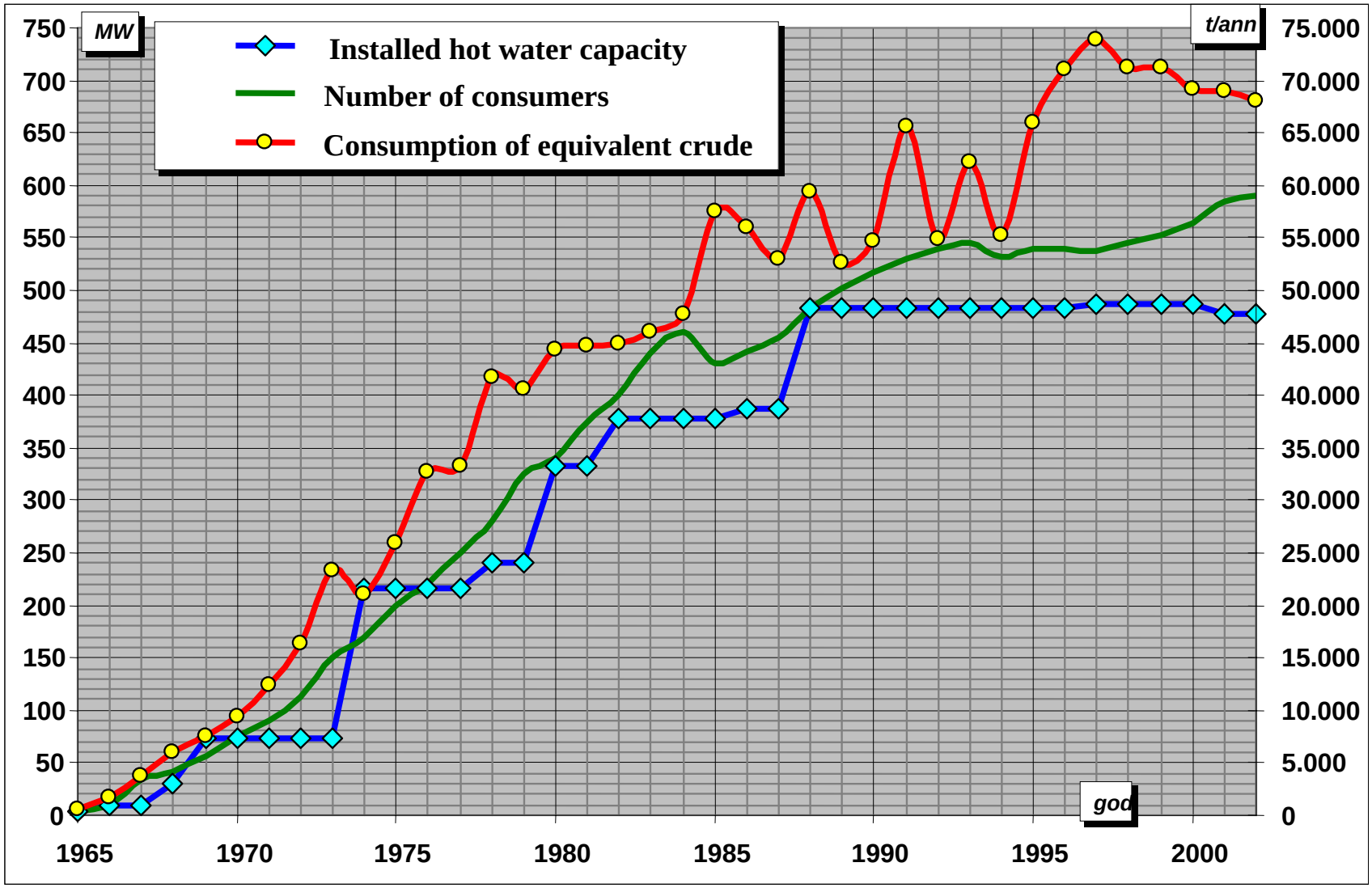
Length of grid ~177 km

Pipelines
DN25 - DN700

Structure of consumers:

- Collective residential buildings **63 %**
- Individual houses **5 %**
- Business buildings **27 %**
- Public sector **2 %**
- Schools **3 %**

TOPIC 6 (CONTINUED)
INSTALLED PRODUCTION CAPACITY, NUMBER OF SERVED CONSUMERS AND FUEL CONSUMPTION



TOPIC 7

SOCIAL PROTECTION, PRICE REGULATION METHOD AND TARIFF SYSTEM FOR THE TARIFF CONSUMERS

- **I group**: Households and humanitarian organizations, local neighborhood units, pre-school institutions and ZOOs
- **II group**: Budget consumers (primary schools, child and youth centers)
- **III group**: by means of special contract, no tariff
- **Ratio among tariff groups I:II:III = 1:1,3:1,7**
- **Charge is made by means of a flat rate per 1m^2 and metering device**

NEW BOOK OF RULES FOR CONDITIONS AND MANNER OF DISTRIC HEATING ENERGY PRICE REGULATION

For regulating the licensed activities:

- Production
- Distribution
- Supply

The method based on encouraging price regulation with the application of:

Method on regulated maximum revenue

shall be used.

TOPIC 7 (CONTINUED)

NEW TARIFF SYSTEM FOR TARIFF CONSUMERS

- **I group** of consumers – households
- **II group** of consumers – non-household
- **Ratio between the groups I : II = 1: 1,5**
- **The charge shall be made on a flat rate per 1m² and by means of a measuring device**

8 TOPIC

DISTRICT HEATING
THE MOST COMMON URBAN HEATING

- **The first district heating system in the world was constructed in 1878 in the town of Lokport, the State of New York**

- **The first district heating system in Europe was constructed in 1900 in the town of Dresden, Germany**

- **The first district heating system in the Republic of Macedonia was constructed in 1965 in the town of Skopje**

TOPIC 8 (CONTINUED)

DISTRICT HEATING: ADVANTAGES AND DISADVANTAGES

- **ADVANTAGES:**

  - fuel savings, from 20% to 30% related with central heating of certain buildings

  - cost-effectiveness

  - possibilities for rational exploitation of local fuels

  - small number of suppliers

  - low costs for fuel, dross and dust transportation

  - more free premises within buildings with separate heating

  - bigger safety concerning hazardous fires

  - bigger advantage concerning the clean environment and other hygienic conditions

- **DISADVANTAGES:**

  - large investments

  - risk from possible discontinuation of heating, with a consequence that certain parts of the city will remain without heating (there must be a reserve type of energy)

TOPIC 8 (CONTINUED)

BASIC DATA ON DECISION MAKING FOR DISTRICT HEATING CONSTRUCTION

- **Population density, number of inhabitants per 1km^2**
- **Heating energy need per 1km^2**
- **Radius of distribution of pipeline system**

- with HOT WATER, with a pressure up to 10 barr and speed of flow ≥ 60 m/s, maximum radius of pipeline system 4 ÷ 5 km, and optimal 2 ÷ 3 km

- with HOT WATER, with a temperature of 150 ÷180^{0}C and speed of flow 1,5 ÷ 3,0 m/s, maximum radius 10 to 12 km, and optimal 6 to 8 km

TOPIC 8 (CONTINUED)

TYPES OF DISTRICT HEATING ON THE BASIS OF PIPELINE SYSTEM

- **SINGLE PIPELINE SYSTEM, that closes the transmission heating ring**
- **DOUBLE PIPELINE SYSTEM, one inflow and outflow pipelines**
- **TRIPLE PIPELINE SYSTEM, one line serves for inflow of heating necessary for the industrial processes, the other line with a variable temperature of water serves the heating needs and the third is the joint outflow line.**

Losses of heating energy in the transmission and distribution network amount to 6% ÷ 12%.

TOPIC 8 (CONTINUED)

MAIN TECHNICAL DATA FOR DISTRICT HEATING DESIGN

- **DENSITY OF HEATING LOAD**
  (ratio between the maximum heating load of the region served and its area, MWh/km^2)

- **SPECIFIC DISTRIBUTION NETWORK LOAD**
  (ratio between the installed capacity and the length of the distribution network or annual delivered heating energy per length unit of the distribution network MW/km or MWh/km)

- **HEATING COEFFICENT** (ratio between the heating load received from the district heating plant and the total heating consumption in a certain region, usually 0,5 ÷ 0,6)

- **ANNUAL USE OF DISTRICT HEATING PLANT** (in hours per year, average value for Germany is 2400 hrs/year for maximum load – with industrial and sanitary hot water consumption)

TOPIC 8 (CONTINUED)

DISTRICT HEATING TYPES ACCORDING TO THE PRESSURE AND THE FLUID TYPE

- **ON THE BASIS OF FLUID'S PRESSURE:**

  - LOW PRESSURE, supplies and area up to 1 km^2, and uses **WATER STEAM** as a heating transmission fluid with a pressure of 2 barr or **HOT WATER** with a temperature ≤ 110 ^0C

  - HIGH PRESSURE, supplies and area up to 75 km^2, and uses **WATER STEAM** as heating transmission fluid with a pressure of up to 12 barr or **HOT WATER** with a temperature of 110 ^0C to 180 ^0C and a pressure of 16 barr

- **ON THE BASIS OF FLUID'S TEMPERATURE :**

  - HOT WATER, with a temperature of up to 110 ^0C, and a return water with a temperature of 70 ^0C

  - BOILING WATER, with a temperature of 150 ^0C ÷180 ^0C and a return of 70 ^0C÷90 ^0C

  DISTRICT HEATING WITH BOILING WATER UNDER HIGH PRESSURE HAS MANY ADVANTAGES COMPARED TO THE OTHER TYPES OF HEATING AND THUS IS THE MOST COMMON ONE.

TOPIC 8 (CONTINUED)

SPECIFIC DATA ON DISTRICT HEATING SYSTEMS IN THE REGION

	Produced heating energy per 1km	Heating load per 1 km^2	Period of district heating plant's operation
Cities	MWh / km	MW / km^2	months
Skopje	3.870	38	6
Belgrade, Serbia	7.380	72	12
Zagreb, Croatia	8.170	80	12
Ljubljana, Slovenia	5.900	58	12
Sofia, Bulgaria	6.000	93	7

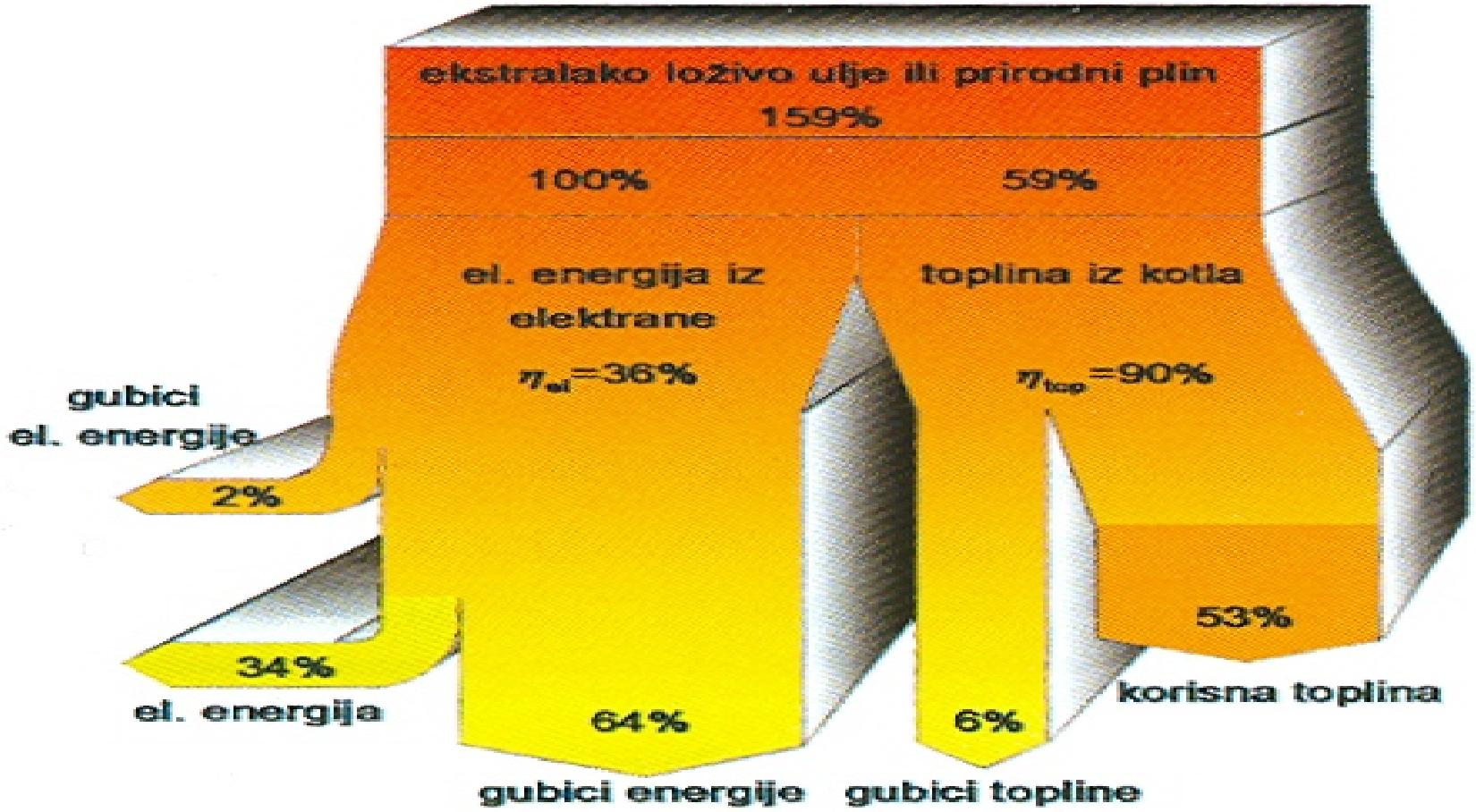
TOPIC 9

ENERGY GENERATION PLANTS

1. DISTRICT HEATING PLANTS AND THERMAL ELECTRICITY PLANTS
2. CO-GENERATION
3. THREE-GENERATION

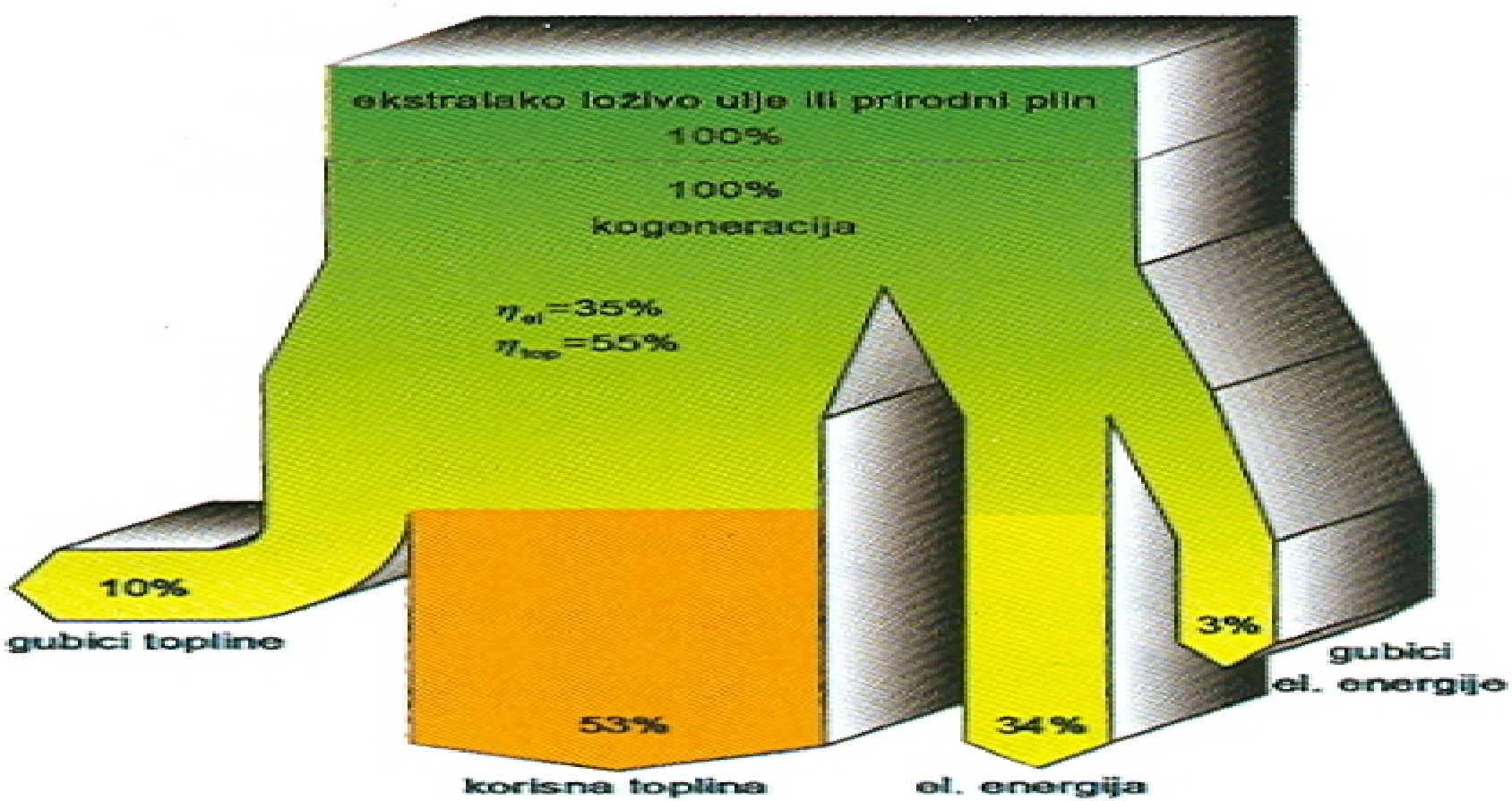
9.1. DISTRICT HEATING PLANTS AND THERMAL ELECTRICITY PLANTS

- **DISTRICT HEATING PLANTS are those that produce only heating energy and sanitary hot water**
- **THERMAL ELECTRICITY PLANTS are those that produce only electricity**



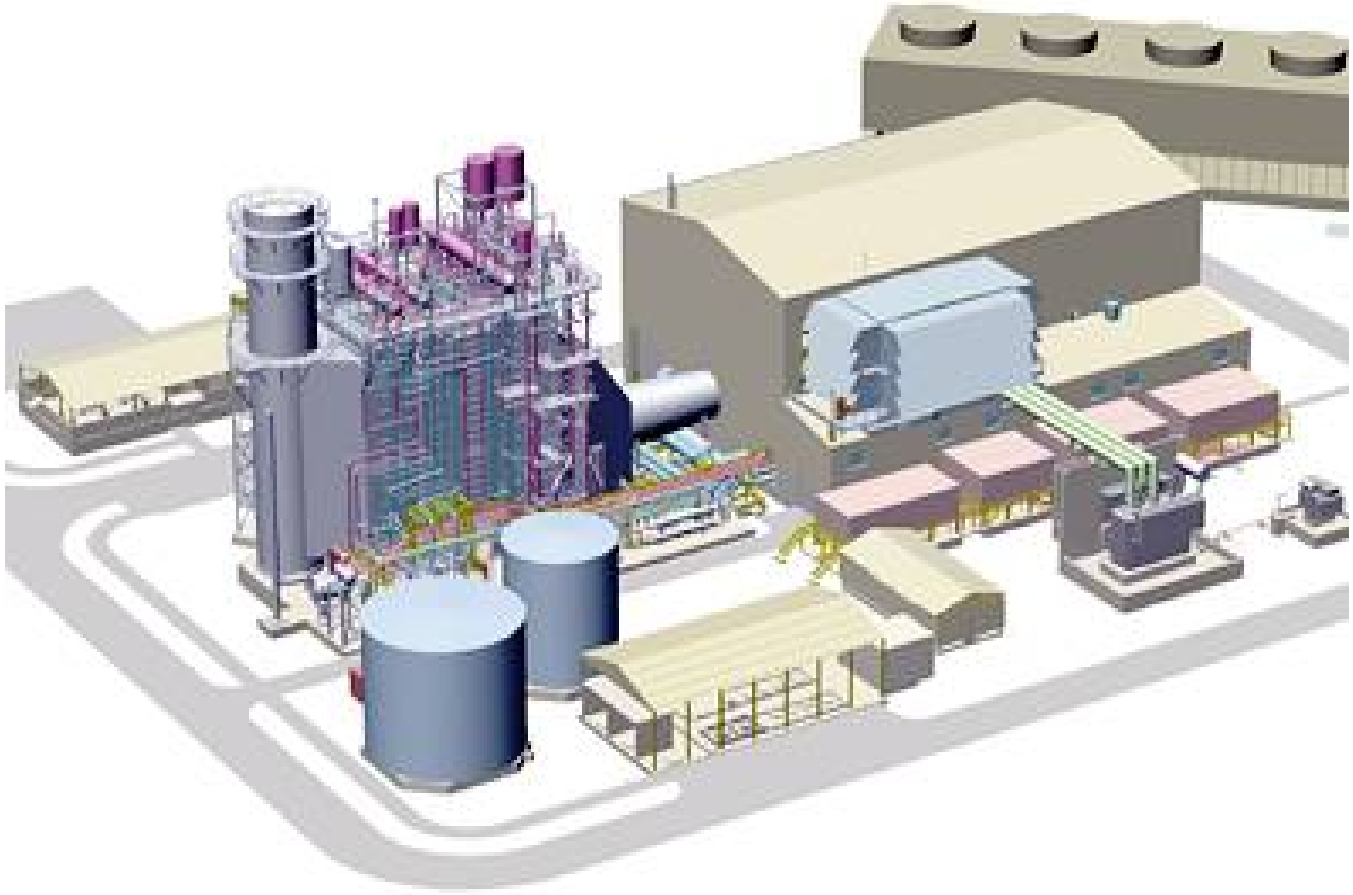
9.2. CO-GENERATION

- **Co-generation is performed in district heating plants-thermal plants where we have a parallel and separate production of two useful types of energy:**
  - heating energy and
  - electricity



TOPIC 9.2. (CONTINUED)

CO-GERENATION PLANT IN SKOPJE TE-DH, THERMAL ELECTRICITY AND DISTRICT HEATING PLANT



The future development of "Toplifikacija" AD lies in its participation in the construction of TE-DH

Location:

Zelezara Skopje

180 MW_{el}

150 MW_{th}

Distric heating -East

20 MW_{el}

60 MW_{th}

ELECTRICITY GENERATION IN CO-GENERATION PLANTS IN EUROPE

- **9% from current electricity generation is gained from co-generation**
- **It is anticipated that by 2010, 18% from the electricity generation will be gained from co-generation**
- **It is anticipated that by 2020, 40% from electricity generation will be gained from co-generation**

9.3. THREE-GENERATION

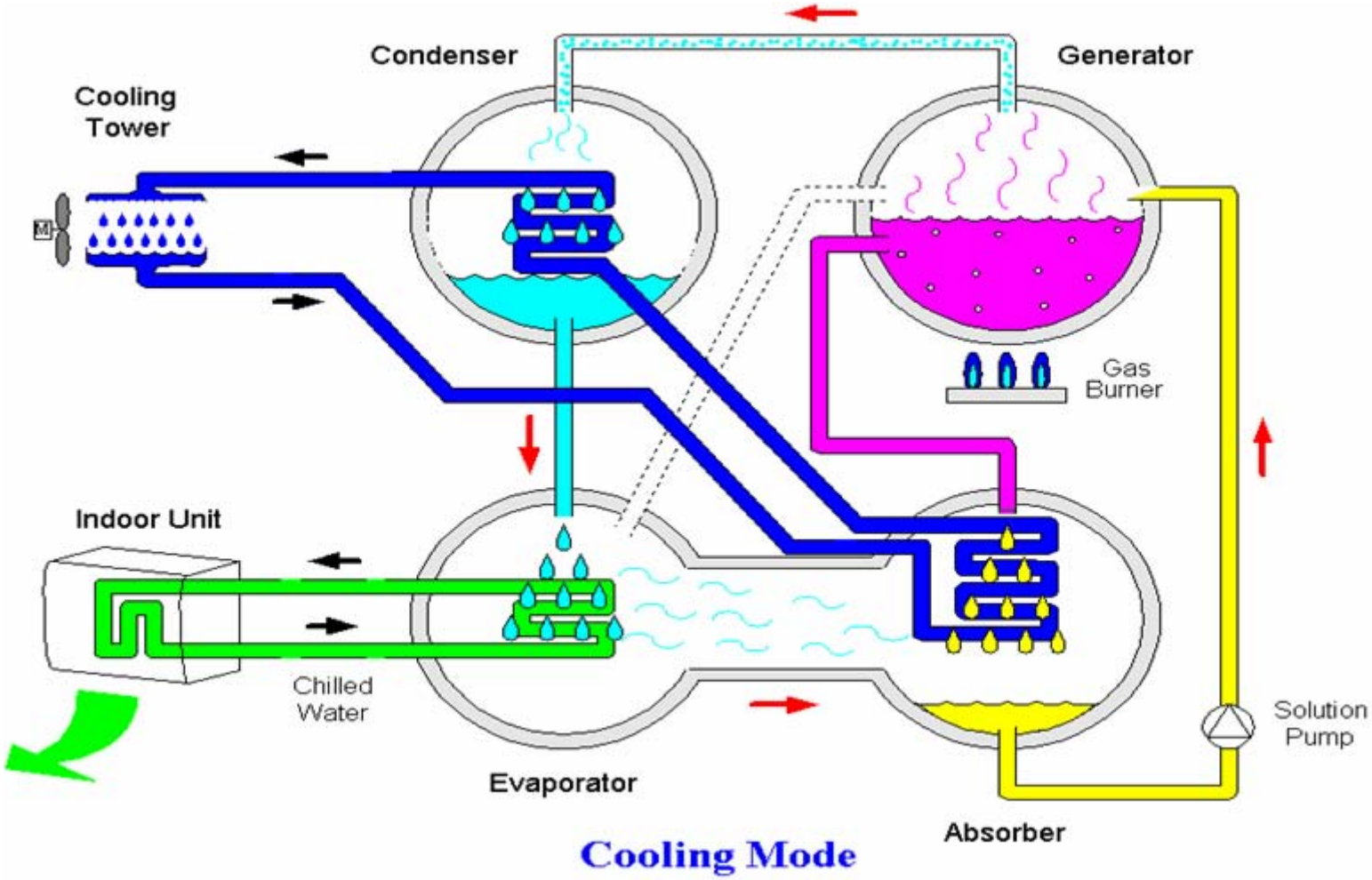
- **Three-generation could be used throughout the whole year and could provide the following three energy types:**
  - heating energy
  - electricity
  - cooling energy, with an in-built absorption cooler

- **Absorption cooler uses only 5 ÷10% electricity compared to the classic electric cooler**

- **Instead of electricity, it could use different types of heating sources such as gas fuel, liquid fuel, steam, hot water, solar energy, hot waste gas, and other hot fluids.**

- **By means of in-built absorption coolers in buildings, 12 ÷13% from the total consumption of electricity could be saved**

Cooling cycle of a small absorption air conditioner

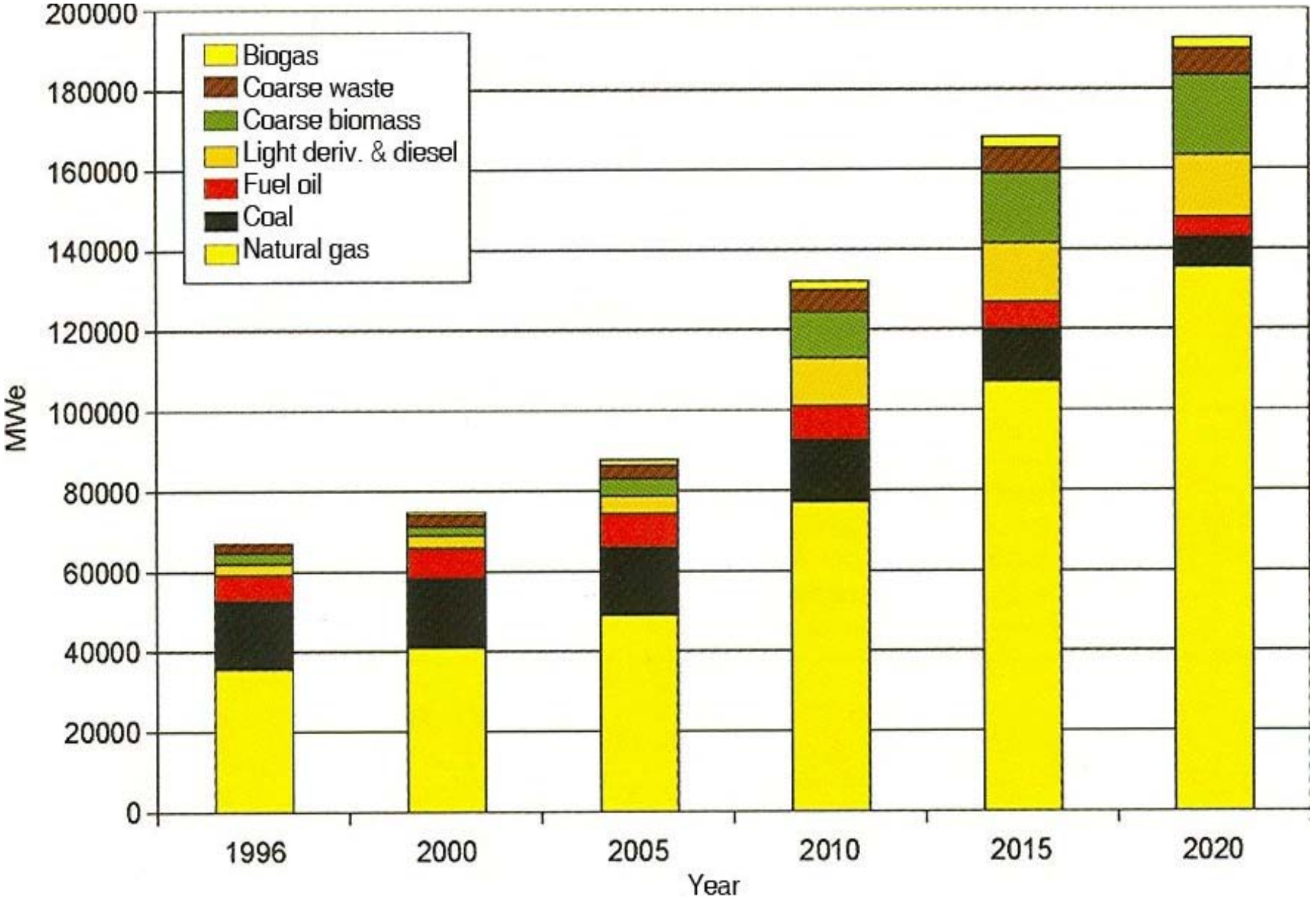


TOPIC 9 (CONTINUED)

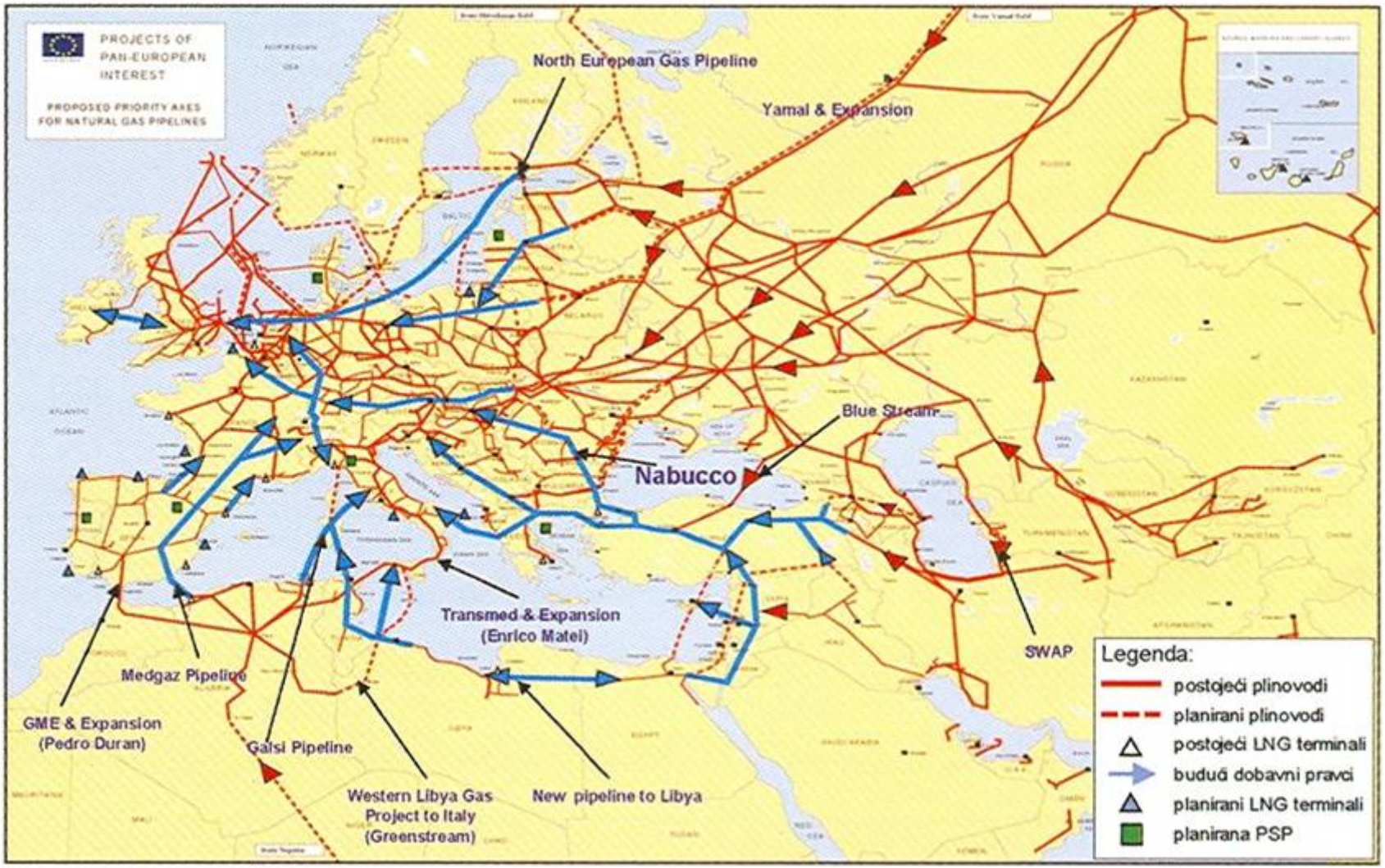
EFFICIENCY DEGREE IN GENERATION ENERGY PLANTS

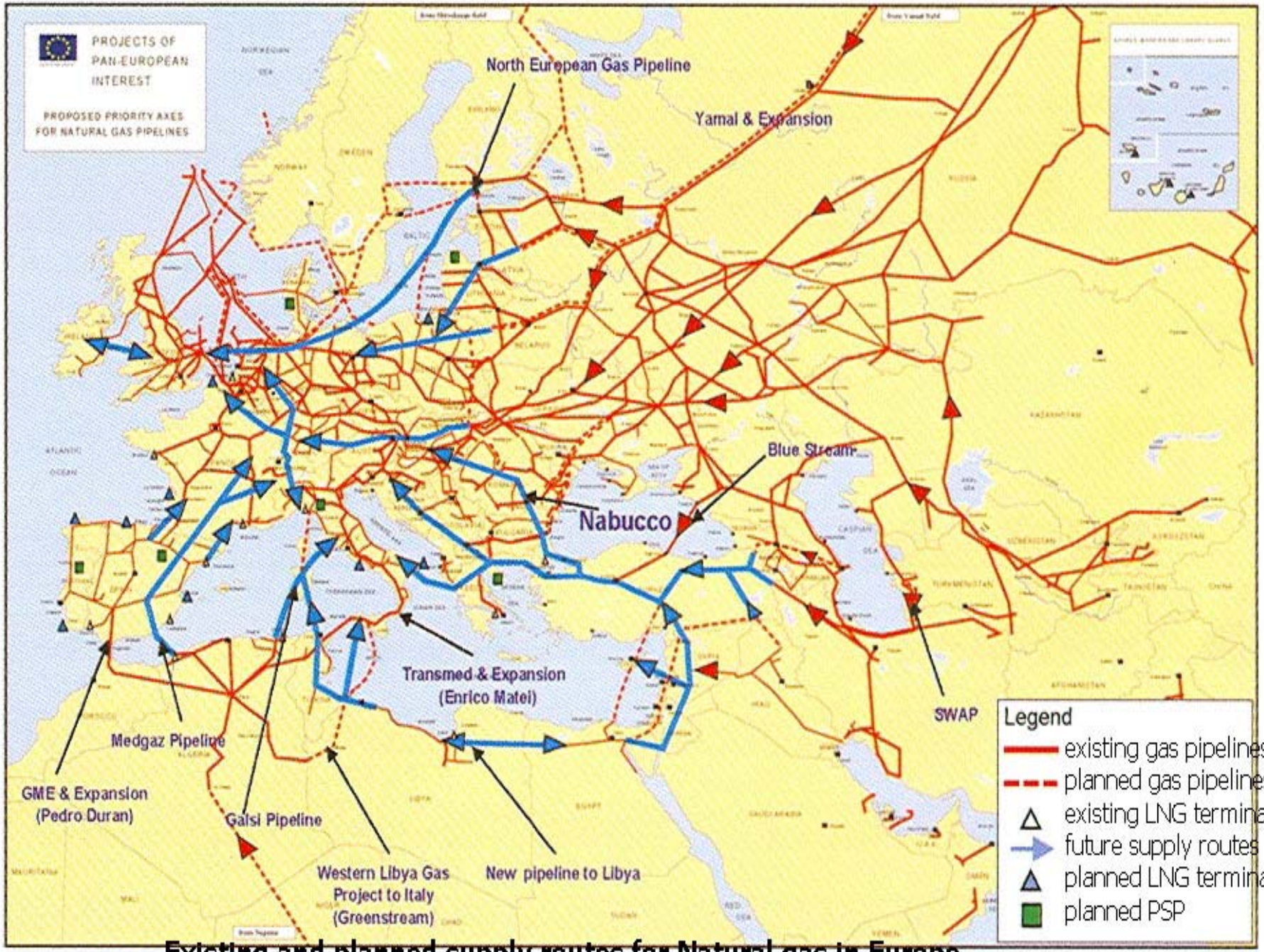
Different energy type generation		Energy fuel	Plant's efficiency degree
1.	Heating energy generation (during winter period)	Natural gas	≤ 95%
		Crude oil	≤ 91%
		Coil	≤ 55% ÷ 65%
2.	Electricity generation	Natural gas, crude oil, coal	≤ 34%
3.	Co-generation of heating energy and electricity during the whole year	When natural gas is used there is up to + 37% overall efficiency compared to the example in point 1.	heating ≤ 53% electricity ≤ 34% total ≤ 87%
4.	Three-generation	Natural gas or crude oil	> 90%

Trends in use of energy fuels in Europe up to 2020



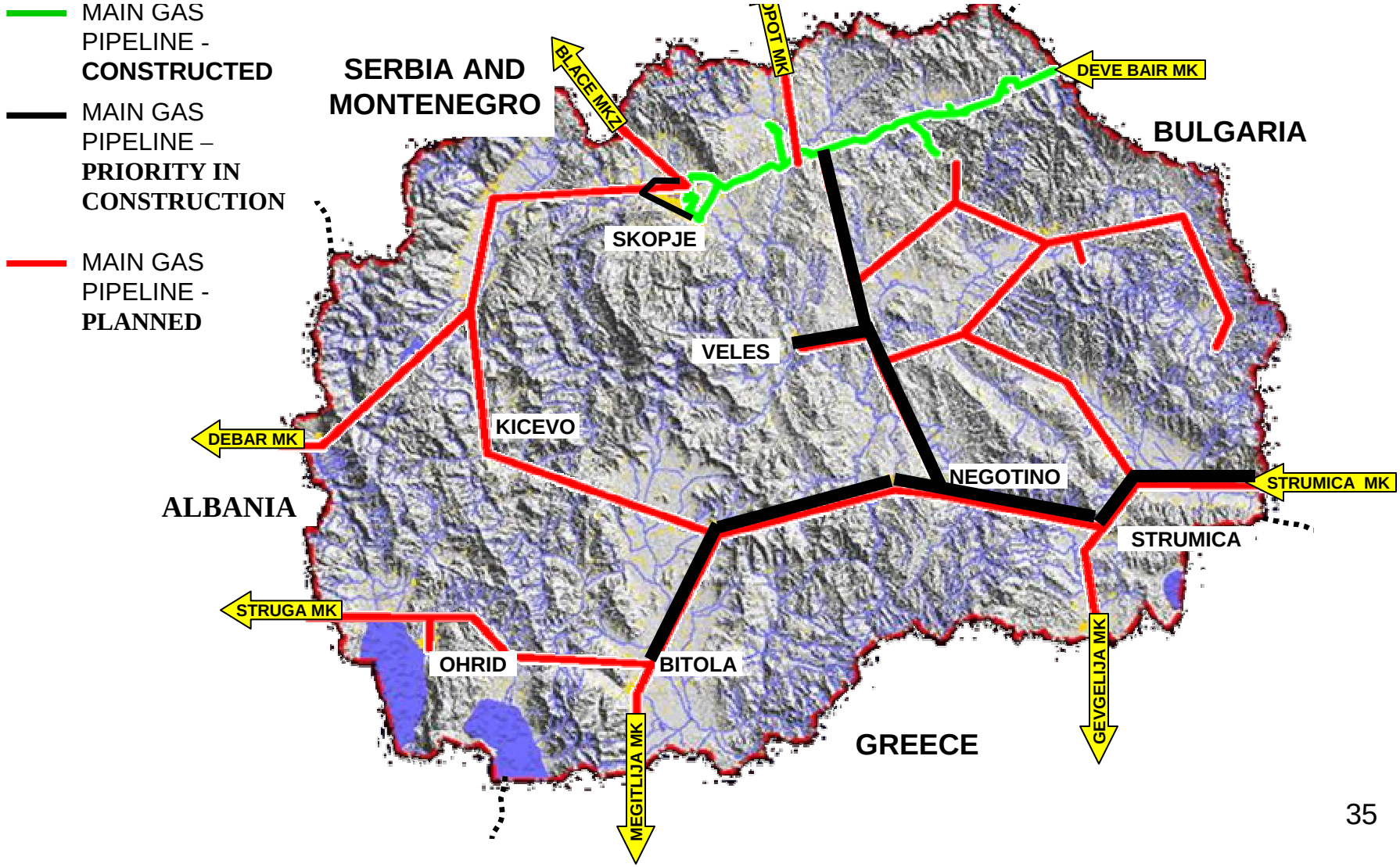
Existing and planned directions for natural gas supply in Europe





Existing and planned supply routes for Natural gas in Europe

MAIN GAS PIPELINE IN THE REPUBLIC OF MACEDONIA UP TO 2020



TOPIC 10 (CONTINUED)

TECHNICAL DATA ON THE EXISTING GAS PIPELINE IN THE REPUBLIC OF MACEDONIA

- Start of natural gas exploitation from 1997
- Natural gas supply comes only from Russia
- Gas pipeline's length in the Republic of Macedonia is about 165 km
- Working pressure of the transmission network is 54 barr
- Main gas pipeline's diameter is 500 мм (20")
- Transmission capacity of gas pipeline is 800.000.000 Nm^3 / year
- Current use of transmission capacity ≈ 10%
- Natural gas in the Republic of Macedonia is used by:
  - 25 industrial consumers, mainly boilers
  - District heating plants

- Future consumption of natural gas in the Republic of Macedonia:
  - the new TE-DH
  - households

THANK YOU
FOR YOUR ATTENTION!