

# Selected issues and topics in the energy policy of the Czech Republic

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# Czech Republic

Area	<b>78 866 km<sup>2</sup></b>
Water	<b>2 %</b>
Population in 2011	<b>10 436 560</b>
Population density	<b>134 / km<sup>2</sup></b>
GDP (PPP)	<b>27 190 USD / per capita</b>
President	<b>Miloš Zeman</b>
Prime Minister	<b>Andrej Babiš</b>
Religion	<b>10.3 % Roman Catholic, 80 % non-declared or non-religious</b>
Ethnic Groups	<b>63.7 % Czechs 4.9 % Moravians 1.4 % Slovaks 29.9 % Other minorities</b>





# Country-specific characteristics of energy sector

- Essential Background of Current Czech Energy Sector
- Specific topics
  - Crude Oil and Natural Gas Introduction
  - Power Utility Sector Development
    - Coal Sector
    - Nuclear Sector
    - RES Sector

**Five country-specific  
essential  
characteristics of  
energy sector**



# Characteristic No. 1 - Tradition

- The former use of wood fuel replaced coal-energy-intensive steam technology in the food industry, transport and industry.
- Use of relatively rich deposits of coal transportation was limited - concentration of infrastructure around the mines.
- Origins of the systematic use of coal - 1930s - Kladno, Ostrava, Rosicko-Oslavany.
- June 22, 1919 - General purpose power companies Act - the need to connect to the network.
- The trend towards centralization of production - unification of networks, voltages and frequencies.

# Characteristic No. 1 - Tradition

- After nationalization of the fragmented electricity sector in 1945, the construction of a single power system began
  - Destroyed infrastructure
  - Planned industry
- 50's and 60's of the 20th century are in the spirit of intensive construction of line structures and linking of local electricity systems
  - Hodonín, Poříčí, Opatovice, Vltavská kaskáda (Lipno, Orlík etc.)
- Inefficiencies in the industry leads to excess of consumption over current production - shutting household off



# Characteristic No. 1 - Tradition

- 60's and 70's are characterized by extensive coal-fired power plants
  - 70's and 80's bring nuclear energy
  - Water installations were built during these years as complementary power plants
  - The backbone of the Czech electricity is thus built on this triangle of coal-fired, nuclear and hydro power plants
- => Czech historical tradition of Energy

## Characteristic No. 2 – Ministers of Industry and Trade

- Ing. Vladimír Dlouhý, CSc. 1.1.1993 – 2.6. 1997 Fakulta informatiky a statistiky VŠE  
ABB, KSK Power Ventur, Pač. komise
- JUDr. Karel Kühnl 2.6. 1997 – 22.7. 1998 Právnická fakulta UK
- Doc. Ing. Miroslav Grégr, CSc. 22.7. 1998 – 15.7. 2002 Strojní fakulta ČVUT (Atomic grandpa)  
Svaz průmyslu České republiky
- Ing. Jiří Rusnok 15.7. 2002 – 19.3. 2003 Národohospodářská fakulta VŠE
- Ing. Milan Urban 19.3. 2003 – 4.9. 2006 Hutnická fakulta VŠB v Ostravě
- Ing. Martin Říman 4.9. 2006 – 8.5. 2009 Fakulta elektrotechnická VUT v Brně  
Středočeská energetická, a.s.; ČEZ,  
a.s.; ČEPS, a.s.; SPČR
- Ing. Vladimír Tošovský 8.5. 2009 – 13.7. 2010 Fakulta elektrotechnická ČVUT  
Středočeská energetická, a.s.; ČEZ,  
a.s.; ČEPS, a.s.
- Ing. Martin Kocourek 13.7.2010 – 14. 11. 2011 Fakulta stavební ČVUT  
Unipetrol, ČEZ
- MUDr. Martin Kuba 16.11 2011 – 10.7.2013 1. lékařská fakulta Univerzity Karlovy  
Českobudějovické teplárny
- doc. Ing. Jiří Cieńciała, CSc. 10.7.2013 – 29.1.2014 Ekonomická fakulta VŠB v Ostravě  
Třinecké železářny, Svazu průmyslu ČR
- Ing. Jan Mládek, CSc. 29.1.2014 – 28.2.2017 VŠE, Prognostický ústav AVČR
- Ing. Jiří Havlíček, MBA 4.4.2017 – 13.12.2017 Národohospodářská fakulta VŠE
- Ing. Tomáš Hüner 13.12.2017 – today Kat. tepel. strojů a jad. zařízení FS na VUT

## Characteristic No. 3 – Privatization

- Energy sector was public service until 1990
  - Politics/strategies and company praxis worked in positively complementary relation
- Since 1990 it is private activity
  - Politics/strategies and company praxis worke in dependent relation, company praxis must deal with restrictive politics/strategies (domestic and EU level)

## Characteristic No. 4 – Structural Changes

- Development after 1989

### General trends in post-revolution development

- 1) Replacement of fully controlled and directly managed energy sector with a system reflecting the interests of the new state
- 2) The process of entering into EU

## Characteristic No. 4 – Structural Changes

- Phase 1 - the restructuring of centrally controlled energy system
- Phase 2 - privatization of key energy companies
- Phase 3 - a stable situation with finished privatization and concentration on completion of the liberalization of energy sector (EU entry).

# Characteristic No. 4 – Structural Changes

- Phase 1 - the restructuring of centrally controlled energy system
  - 50 state enterprises, restructuring of coal sector, unbundling (CEZ, CPP)
- Phase 2 - privatization and liberalization of key energy companies
  - Natural gas (Transgas), Oil (refineries, transport) vs. electricity (CEZ)
- Phase 3 - a stable situation with finished privatization and concentration on completion of the liberalization of energy sector (EU entry).
  - Current situation: stable energy sector with strong national company, diversification of oil and gas, better energy efficiency and ecologization of energy sector, liberalized market with electricity and gas, however high energy intensity (1/3 above EU average), dependence on coal and nuclear, export of electricity, old production units etc.

## Characteristic No. 4 – Structural Changes

- Until 1990, the vast majority of energy companies was in public/state ownership - a very long tradition
- After 1990, the privatization came into process, which has been far from successful in some sectors
- At the same time the transition to a democratic system took place
- And concurrently the EU liberalization process took place

As a result, these were **major changes** that **induced resistance** and chaos among cadres and people who have studied and acquired their work experience in the energy in the period of socialism



## Characteristic No. 5 – Status of the power utility sector base

- Coal (!)
  - Uranium
  - Water
  - Gas from Russia
- 
- Unsuitable geographical and meteorological conditions for renewables development



## Relevant commodities

<b>Commodity</b>	<b>Resources</b>	<b>Reserves</b>	<b>Mine production</b>
Lignite	1 903 000	819 053 000	262 000
Subbituminous coal	915 100 000	4 468 789 000	43 931 000
Hard coal	168 917 000	7 545 818 000	11 193 000
Uranium	374	20 843	259
Crude oil	1 415 000	19 899 000	173 000
Natural gas	4 767 000 000	8 404 000 000	201 000 000

# Czech Energy Sector

## Key Energy Statistics

Source	Consumption	Imports	TPES share	Electricity Generation share
Crude Oil	9.81 Mt	98%	17.1%*	0.1%
Natural Gas	8.41 bcm	111%	15.8%	1.3%
Coal (all types)	52.3 Mt	6%	42.7%	57.1%
RES	-	-	7.5%**	9.2%
Nuclear Energy	-	-	17.2%	32.3%

\* Oil products imports add another 3.1% of TPES share

\*\* Biofuels and waste stand for 6.5% of TPES share and 3.2% of Electricity Generation share

Note: 2011 data; Source: *U.S. Energy Information Administration; International Energy Agency; OECD & IEA, 2013; compiled and calculated by T. Vlcek*

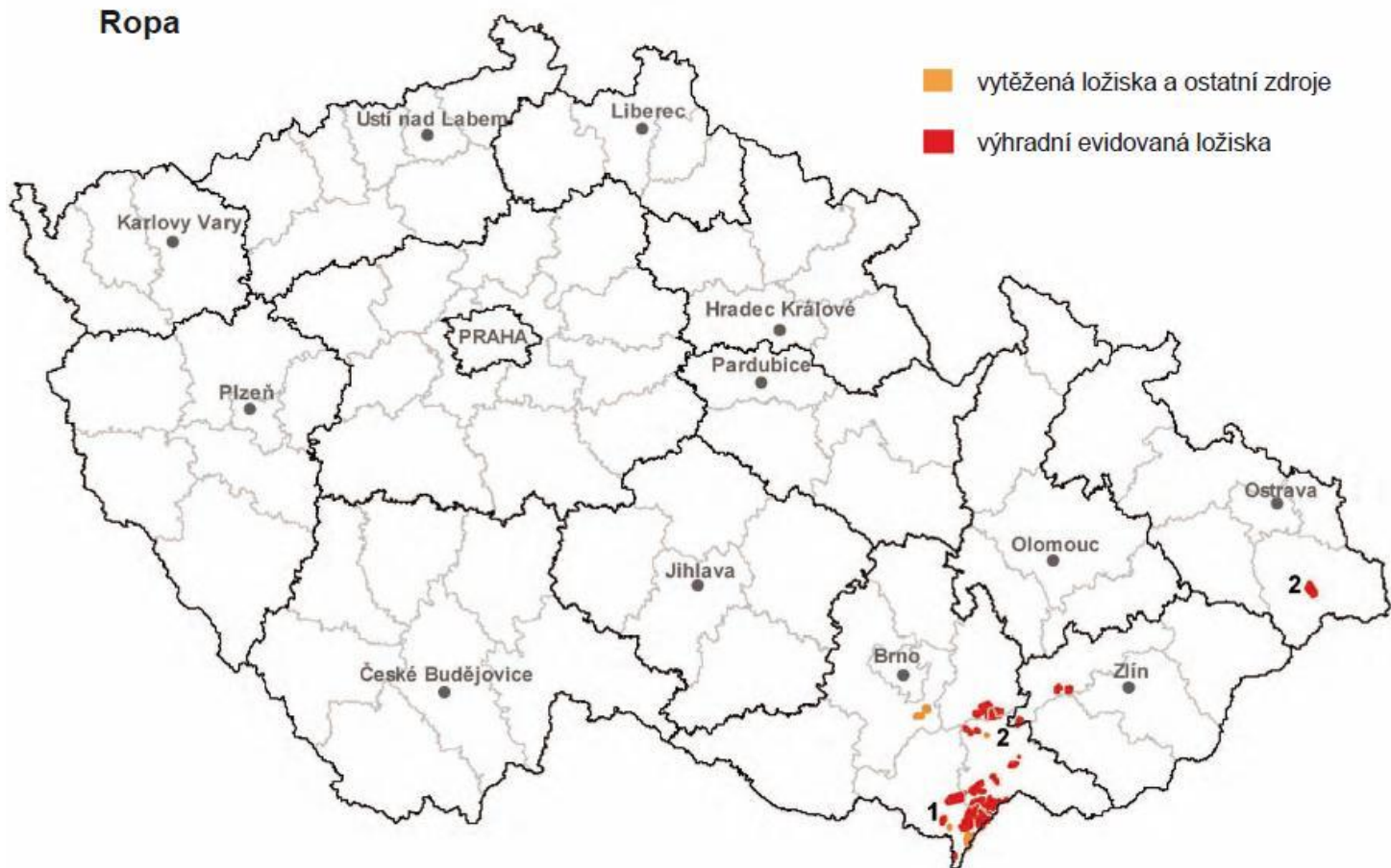
# Crude Oil and Natural Gas Introduction



# Crude Oil Supply Issues

- Oil production in the Czech Republic in 2014 reached the value of 0.148 milion tons, ie 2% of consumption in the Czech Republic in 2014

Total consumption in the Czech Republic in 2014 amounted to 7.370 milion tons of oil



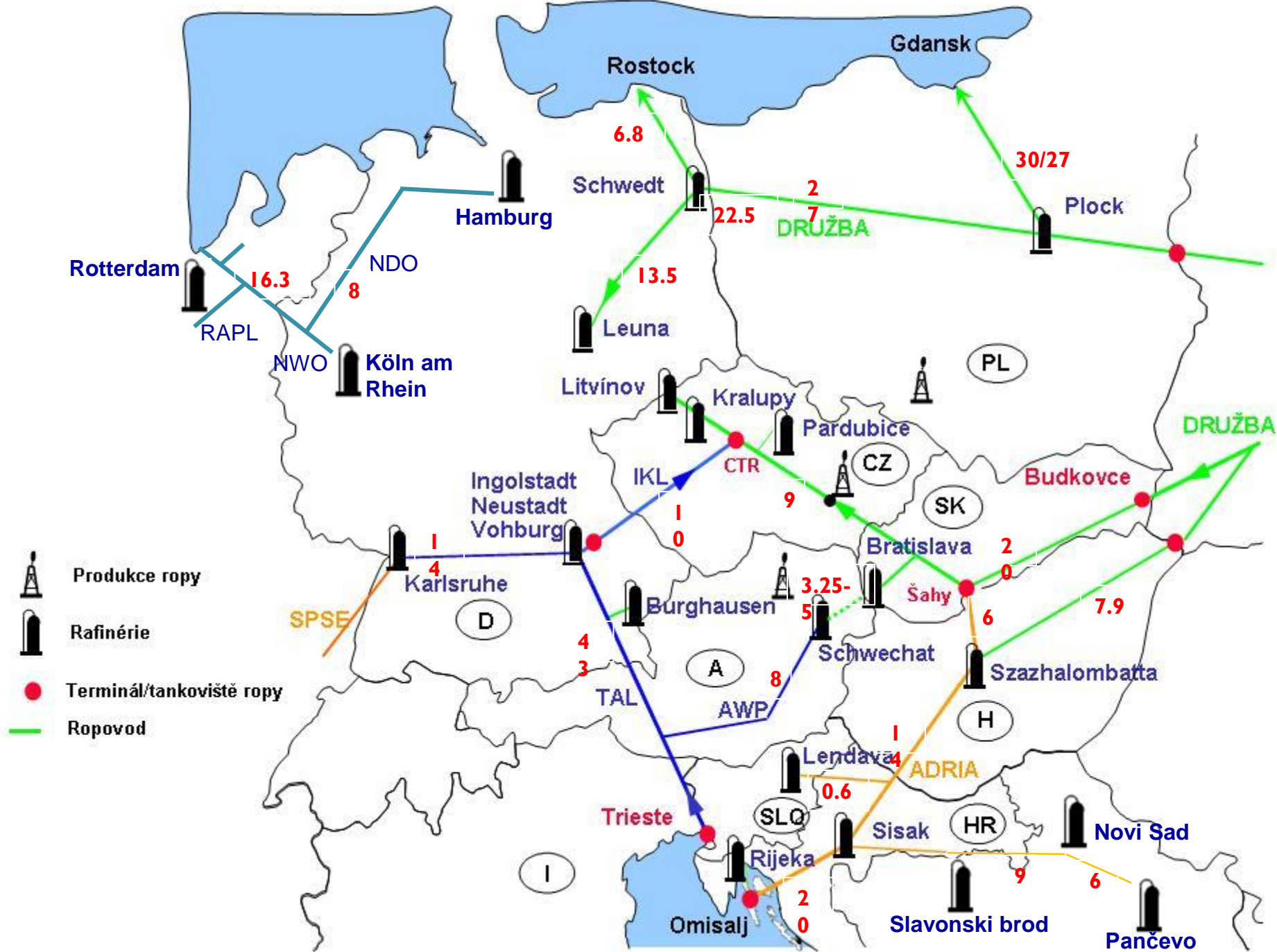
<b>Pipeline Routes in the Czech Republic</b>		
	<b>Druzhba</b>	<b>IKL</b>
<b>Start of Supply</b>	1962 (Slovakia), 1964 (Czech Rep.)	1996
<b>Transport Capacity (Mt/y)</b>	9	10
<b>Supply Volume (tons, 2010)</b>	4.536	3.192
<b>Percentage Rate (% , 2010)</b>	58.7	41.3
<b>Supply Volume (tons, 2012)</b>	2.993	4.082
<b>Percentage Rate (% , 2012)</b>	42.3	57.7
<b>Supply Volume (tons, 2014)</b>	3.729	3.641
<b>Percentage Rate (% , 2014)</b>	50.6	49.4
<b>Utilization (%) 2010/2012/2014)</b>	50.40 / 33.26 / 41.43	31.92 / 40.82 / 36.41
<b>Source</b>	Russia	Algeria, Azerbaijan, Italy, Kazakhstan, Libya, Nigeria, Norway, Russia, Syria
<b>Pipeline Transit Countries</b>	Russia, Belarus, Ukraine, Slovakia	Italy, Austria, Germany

Note: The route of the south branch of the Druzhba pipeline, which transports supplies to the Czech Republic, crosses Almetevsk - Kuybyshev - Unecha - Mozyr - Brody - Uzhhorod - Sahy - Litvinov. Also, crude oil coming from Russia is not necessarily Russian.

Source: Ministry of Industry and Trade of the Czech Republic, 2009d, p. 1, Czech Association of Petroleum Industry and Trade, 2010, p. 8; "Druzhba Pipeline", 2009, p. 56; Ministry of Industry and Trade of the Czech Republic, 2011, p. 15

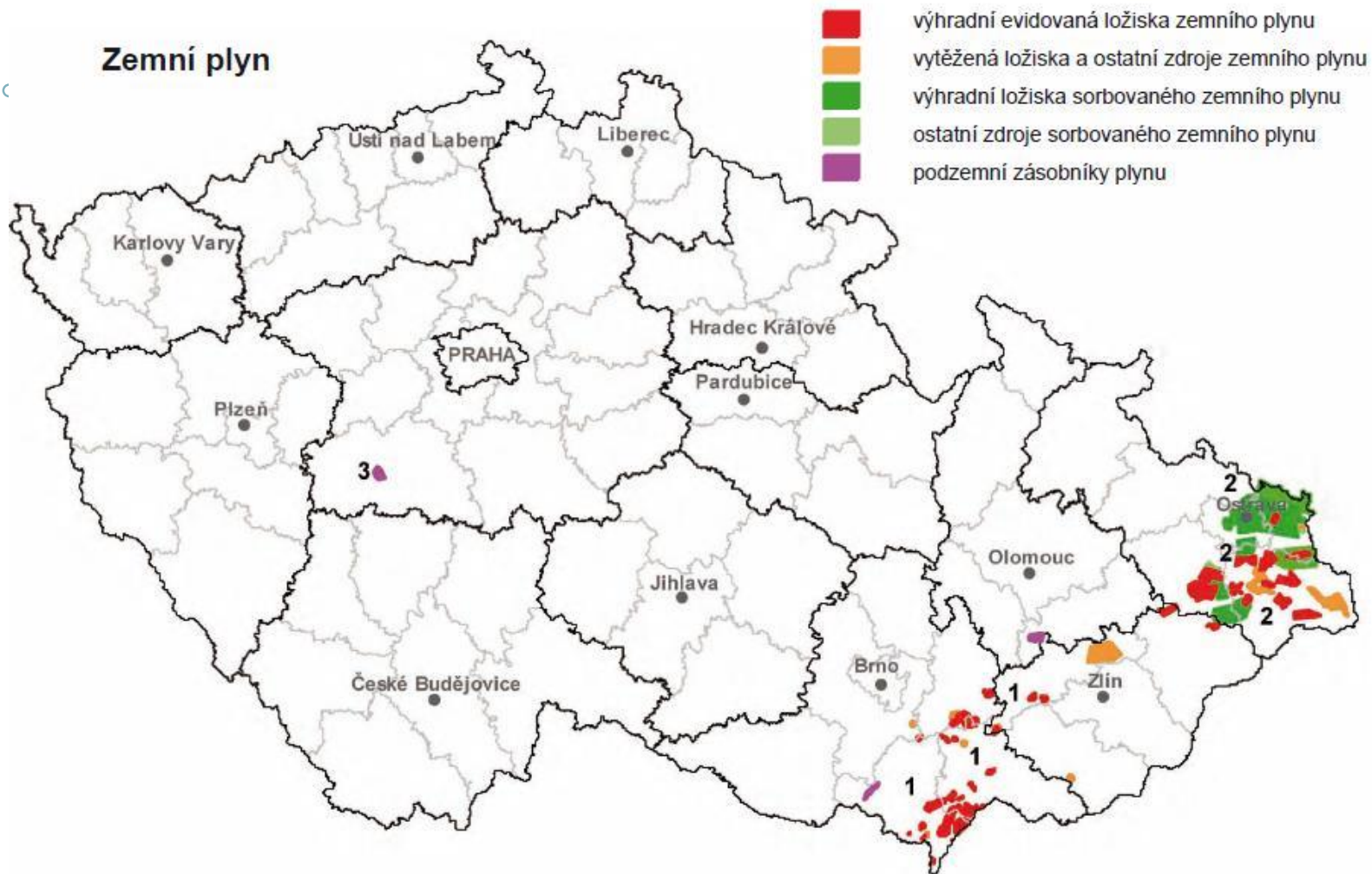








## Zemní plyn



- **Natural Gas Diversification and Liberalization Issues**

- Natural Gas production in the Czech Republic in 2014 reached the value of **0.198 bcm/y**, ie 2.7% of consumption in the Czech Republic in 2014

- Total consumption in the Czech Republic in 2014 amounted to **7.28 bcm/y**

Deposits, reserves and mine production of natural gas in the Czech Republic

	2008	2009	2010	2011	2012	2013	2014
Deposits – total number	88	92	94	83	90	96	93
- exploited	41	49	52	48	46	40	40
Total mineral reserves	46 044	46 140	28 924	30 172	30 506	31 085	27 949
- economic explored reserves	4 265	4 339	6 123	7 374	7 243	7 646	7 491
- economic prospected reserves	39 807	39 895	2 281	2 335	2 791	2 981	2 956
- potentially economic reserves	1 973	1 906	20 520	20 463	20 472	20 458	20 458
- exploitable (recoverables) res.	27 812	27 846	4 767	4 660	4 886	5 512	5 064
Mine production	168	180	201	187	204	207	198

Note: reserves numbers in bcm.

Source: Ministerstvo životního prostředí / Česká geologická služba Geofond.

<b>Natural Gas Supplies and the Most Important Companies in the Gas Sector</b>		
	<b>Russian Federation</b>	<b>Kingdom of Norway</b>
<b>Launch of Supply</b>	1967	1997
<b>Volume of Supplies (bcm/y, 2009)</b>	5,099	3,0
<b>Proportional Share (% , 2009)*</b>	58,81	34,60
<b>Resource Areas</b>	Mostly from the fields of Urengoy, Yamburg and Medvezhye	Fields Draupner E, Sleipner, Troll A, Mikkell, Kristin and other fields in the continental shelf of the Norwegian Sea
<b>Transit Countries</b>	Ukraine, Slovakia	Germany
<b>Conclusion of Current Contract</b>	October 1998, 2006**	May 1st, 1997***
<b>Contract</b>	Until 2035****	Until 2017
<b>Volume of contract</b>	8-9 bcm/y	53 bcm in total, ca. 3,0 bcm/y

\* Zbylých 4,59 % představuje dovoz ze Spolkové republiky Německo, v objemu 571 mil. m<sup>3</sup>.

\*\* In October 1998, a contract between Transgas, a. s. and OOO Gazexport was signed for the supplies of 8 to 9 bcm/y of natural gas for the period of 15 years. Thee contract with a defined price and transport route should run until 2013. In 2006, RWE Transgas, a. s. (successor to Transgas, a. s.) extended the contract until 2035. This extension nevertheless did not include the definition of the gas price or transport route.

\*\*\* With Statoil, Norsk Hydro a Saga Petroleum

\*\*\*\* This, at the same time, means the definite securing of the Czech Republic's transit position until this year, as one third of the natural gas supplied by Russia to Western Europe will continue to be transported through Czech territory.


Source: T. Vlček; supply volumes and contracts according to Ministerstvo průmyslu a obchodu ČR, 2010g, s. 4-5; Kastl, 2008.

- Gas pipeline
- - - Proposed gas pipeline
- Member States of the European Union
- Russia

0 500 Kilometers  
0 500 Miles

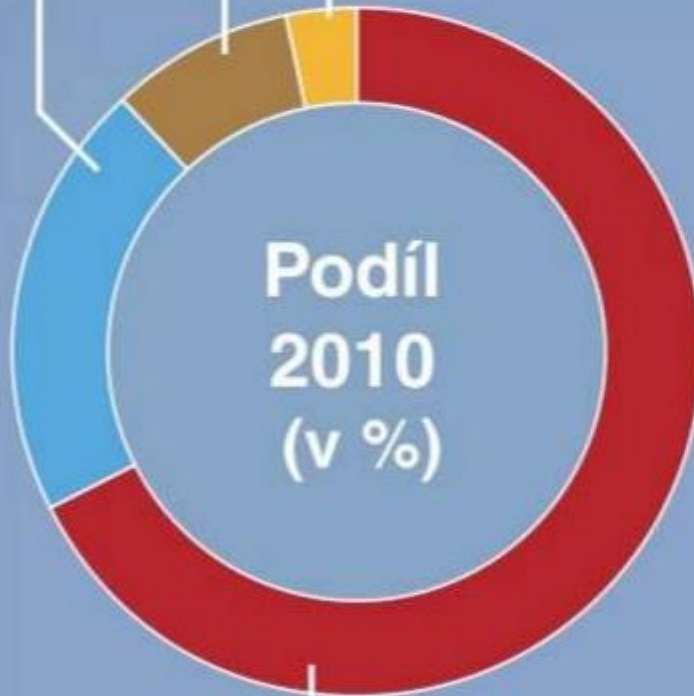


- Trade with gas is specific in that it proceeds on the bases of long term contracts, in spite of the developing EU liberalization activities
- 96% of natural gas supplies are provided by two companies.
  - Moravske naftove doly, a. s. procures the supplies from domestic production. These amount to less than 1% of the demand in total.
  - RWE Transgas, a. s. has concluded contracts with OOO Gazprom Export, the supplier of Russian gas, until 2035 and with a consortium of Norwegian producers (ExxonMobil Production Norway Inc., Statoil Hydro ASA, Norske ConocoPhillips AS, TOTAL E&P NORGE AS, ENI Norge AS) until 2017.
  - VEMEX s. r. o. has contracts with OOO Gazprom Export until 2012 with a possibility of further extension.
  - Since 2008, other companies have also started to import natural gas to the Czech Republic: Ceska plynarenska, a. s., which obtained the purchase contract for gas in Norway (0.1 % of total Czech import of natural gas in 2008), company Lumius, spol. s r. o., which buys natural gas mainly in Germany (0.5 % of total Czech import of natural gas in 2008) and German company WINGAS GmbH & Co.KG. (1.7 % of total Czech import of natural gas in 2008).
  - Although the expansion of suppliers with natural gas becomes a modern trend, the extent of contracts is still rather insignificant and it does not have a major impact on the gas market.

- 
- Since 2007 the gas sector is fully liberalised (98/30/EC, 2003/55/EC, 2009/73/EC)
  - There were 122 licensed gas traders on 1. 1. 2011
  - The Czech Republic is provided with gas supplies on the basis of the long term contracts with producers, which limits its implementation of EU liberalization measures, but, on the other hand, provides stability and guarantees to both exporters and importers.
  - The Czech Republic will, therefore, with great likelihood remain an important transit country, while the natural gas producers will continue using the Czech territory for transit purposes, which is by itself a safeguard of the maintenance of supplies for its own needs.
  - The long term contracts with suppliers, however, limit its liberalization efforts. If the greatest part of natural gas is provided to the Czech Republic on the basis of the long term contracts, intrastate liberalization and the growth of new traders would de facto face the fact that one and the same gas is being traded only with more mediators in between.
  - Almost all of the gas the gas traders sell comes from Transgas
  - Liberalization is in that manner still unfinished and it will not take place in an effective manner in the forthcoming period either.

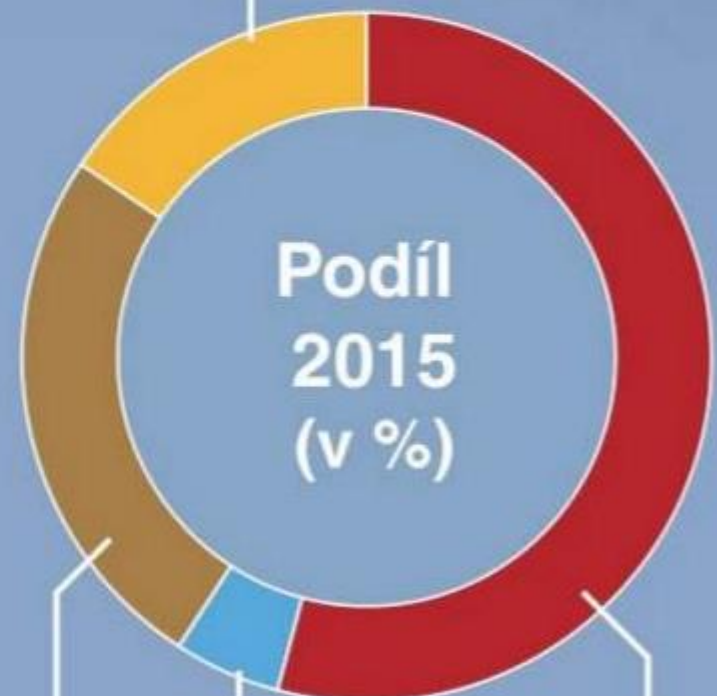
# Odkud Česko dováží plyn

Norsko 20,47  
Německo 8,78  
Ostatní 3,12



Rusko  
67,63


Ostatní 15,54



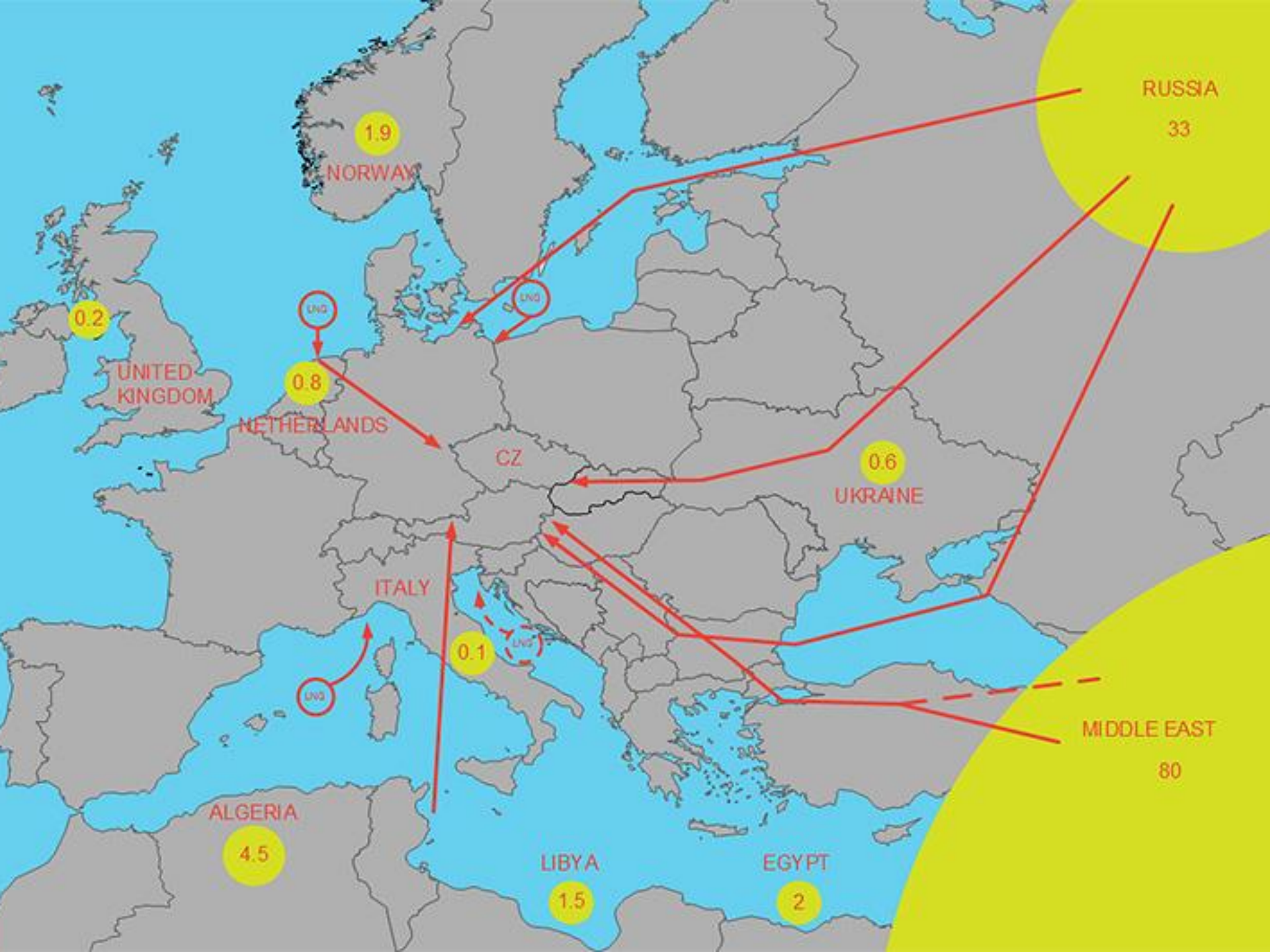
Německo  
25,10

Norsko  
5,14

Rusko  
54,22

- 
- Czech Republic as EU gas transit country
    - Geography
    - Great infrastructure (still the only reverse flow system in Eastern Europe)
    - Czech and EU projects strengthen this position
    - Enhancement of the strategic reservoirs
    - Increase in consumption due to natural gas use in electricity production and transportation
    - Infrastructure developments related to SEP 2015





## Current projects in the gas sector

1 – Stork II pipeline until 2020 (connection to Poland, 7 bcm to PL, 5 bcm to CR)

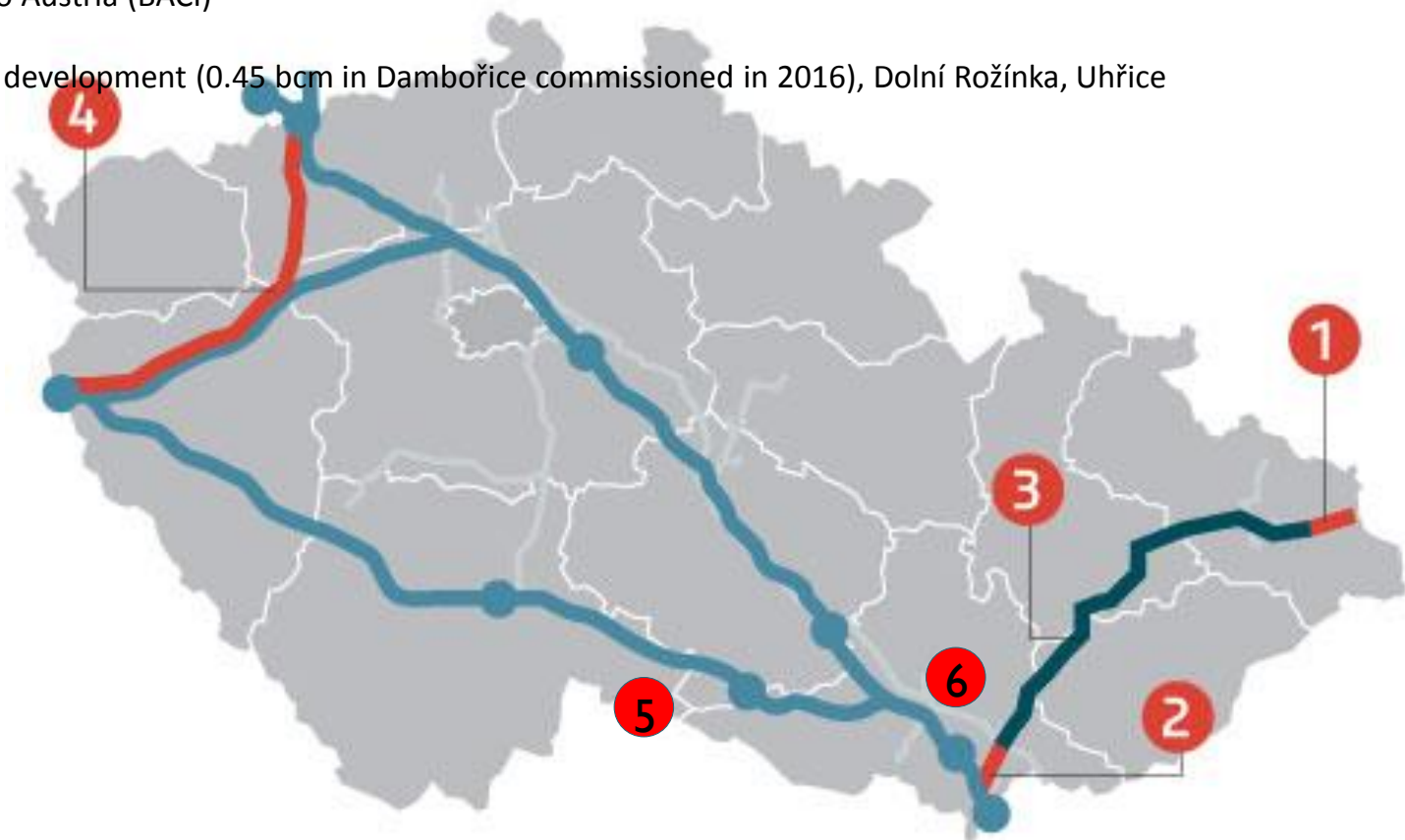
2 – Increase of the connection of the underground reservoirs Tvrdonice and Dolni Dunajovice in the Southern Moravia to the transit system

3 – North-South gas corridor enhancement and reverse flow capacity enhancement (Moravia pipeline, 32 km, 14 bcm)

4 – Gazela pipeline (166 km, Brandov-Weidhaus, 33 bcm)

5 – pipelines to Austria (BACI)

6 – reservoirs development (0.45 bcm in Dambořice commissioned in 2016), Dolní Rožínka, Uhřice



# Coal in the CR



# Coal in the Czech Republic

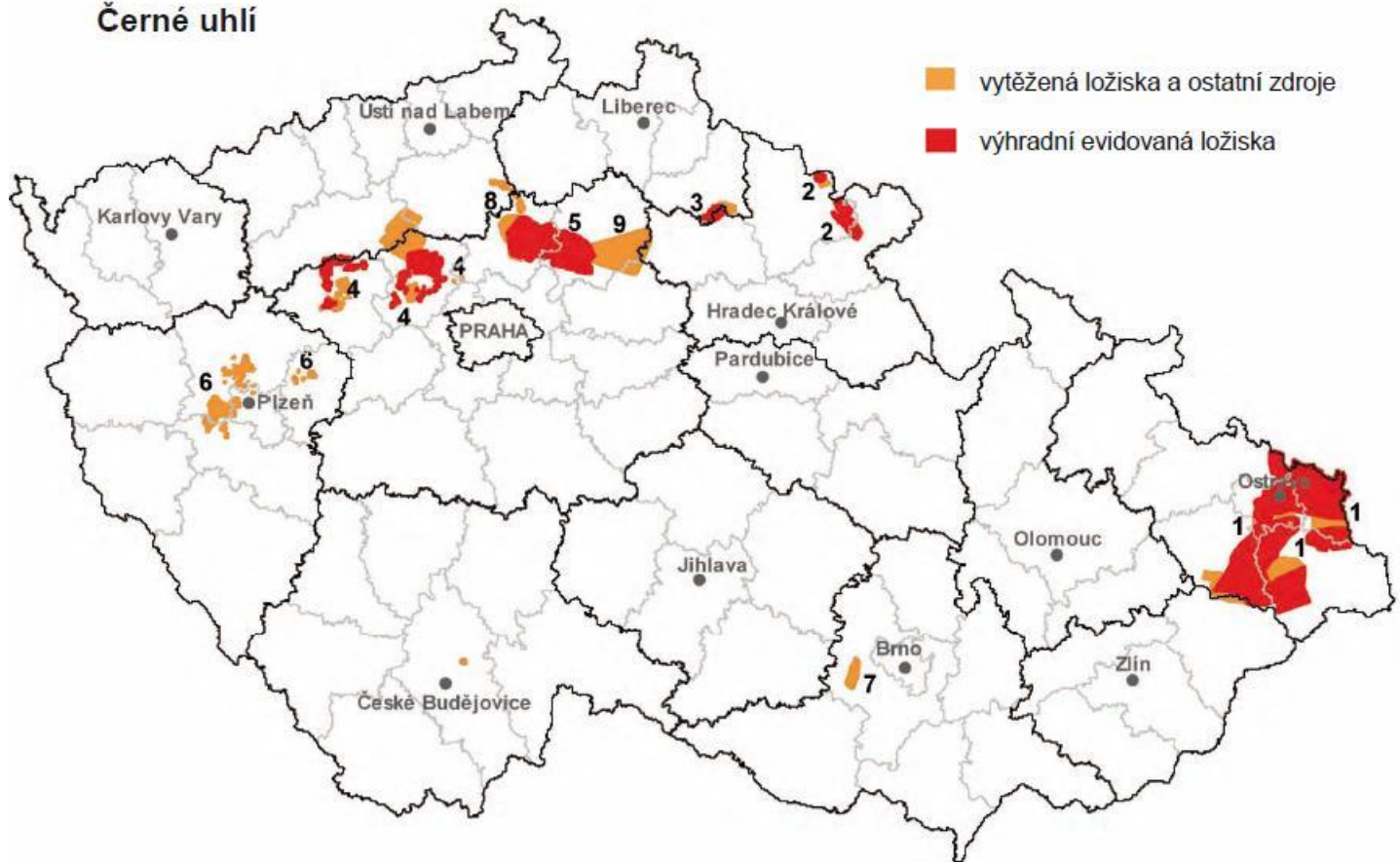
<b>Installed Capacity in the Czech Electricity Grid on 31 December 2012</b>		
<b>Type of Power Station</b>	<b>Installed Capacity (MWe)</b>	<b>Percentage (%)</b>
Thermal Power Station	10644	51.9
Gas Combined Cycle Power Station	521	2.5
Gas Fired Power Station	750	3.7
Hydroelectricity	1069	5.2
Pumped-storage Hydroelectricity	1147	5.6
Nuclear Power Station	4040	19.7
Wind Power	263	1.3
Solar Power	2086	10.2
Geothermal Power	0	0
<b>Total</b>	<b>20520</b>	<b>100</b>

Source: Energeticky regulacni urad, 2013, s. 11.

## Coal Power Plants in the Czech Republic with more than 150 MWe of Installed Capacity

Power Plant	Owner	Installed Capacity	Connected to the Grid	Fired on	Life Expectancy*
<b>Detmarovice</b>	CEZ, a. s.	800 MWe	1975 - 1976	Bituminous coal	2020-2030
<b>Chvaletice</b>	Severni energeticka a.s.	800 MWe	1977 - 1978	Brown coal	2020-2029
<b>Kladno</b>	Alpiq Generation (CZ), s. r. o.	299.1 MWe	1976, 1999	Bituminous coal, brown coal	2045-2050
<b>Komorany</b>	United Energy pravni nastupce, a. s.	239 MWe	1959, 1978, 1986, 1994, 1997, 1998	Brown coal**	2025
<b>Ledvice II</b>	CEZ, a. s.	220 MWe	1966-1968	Brown coal	2015
<b>Ledvice III</b>	CEZ, a. s.	110 MWe	1998	Brown coal	2040-2055
<b>Ledvice IV</b>	CEZ, a. s.	660 MWe	2014 - 2015	Brown coal	2055
<b>Melnik (II)</b>	CEZ, a. s.	220 MWe	1971	Brown coal	2015-2020
<b>Melnik (III)</b>	CEZ, a. s.	500 MWe	1981	Brown coal	2015-2020
<b>Melnik (I)</b>	Energotrans, a. s.	352 MWe	1961, 1994 - 1995	Brown coal	?
<b>Opatovice</b>	Elektrarny Opatovice, a. s.	378 MWe	1979, 1987, 1995 - 1997	Brown coal	2020-2030
<b>Pocerady</b>	CEZ, a. s.	1,000 MWe	1970 - 1977	Brown coal	2029+
<b>Porici</b>	CEZ, a. s.	165 MWe	1957	Brown coal, bituminous coal**	?
<b>Prunerov II</b>	CEZ, a. s.	1,050 MWe	1981 - 1982	Brown coal	2015-2023 (2040***)
<b>Prunerov I</b>	CEZ, a. s.	440 MWe	1967 - 1968	Brown coal	2015-2023 (2040***)
<b>Tisova I</b>	CEZ, a. s.	183.8 MWe	1959 - 1961	Brown coal	2020+
<b>Tisova II</b>	CEZ, a. s.	112 MWe	1959 - 1961	Brown coal **	2020+
<b>Trebovice</b>	Dalkia Ceska Republika, a. s.	174 MWe	1961, 1998	Bituminous coal, light fuel oil	2015-2020
<b>Tusimice II</b>	CEZ, a. s.	800 MWe	1974 - 1975	Brown coal	2035

## Černé uhlí



1 – česká část hornoslezské pánve

2 - česká část vnitrosudetské pánve

3 - podkrkonošská pánve

4 - středočeské pánve

5 - mšensko-roudnická pánve 6 - plzeňská a radnická pánve

7 - boskovická brázda

8 - mšensko-roudnická pánve 9 - mnichovohradištská pánve

# Coal in the Czech Republic

<b>Exploitable Reserves of Bituminous Coal</b>				
<b>Mine</b>	<b>Exploitable Reserves</b>	<b>Production*</b>	<b>Life Expectancy**</b>	<b>Number of Employers***</b>
Karvina****	23,975	2,621	6.7	4,422
Darkov	12,216	2,651	4.1	3,264
CSM	29,200	2,475	10.7	3,494
Paskov	850	863	-	3,003
<b>Total</b>	<b>66,241</b>	<b>8,610</b>	<b>-</b>	<b>14,183</b>

\* As of 2013

\*\* Calculated as Exploitable Reserves divided by 3-year average production, both coke and energy coal included

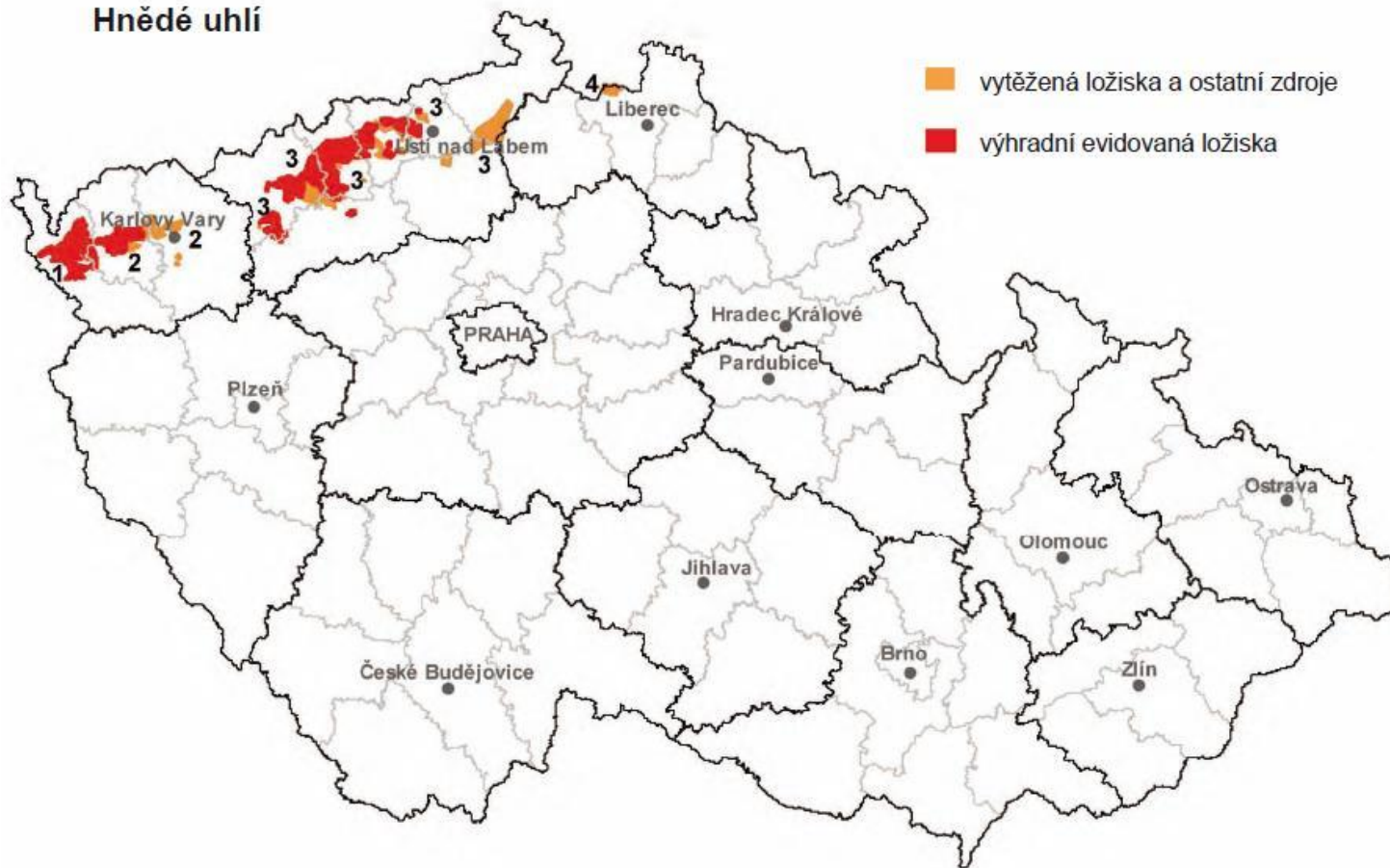
\*\*\* As of 2013; including supply companies

\*\*\*\* Created by joining former mines CSA and Lazy in 2008

Note: figures in thousands of tons; Exploitable Reserves as of Ministry of Environment of the Czech Republic geological statistics; Life Expectancy in years. Mines Karvina and Darkov will be connected in one mine from 2015. The expected year of definitive end of bituminous coal production is 2040 according to Ministry of Industry and Trade.

Source: OKD, 2014, p. 7-11; *OKD, a.s.*; calculations of life expectancy by T. Vlcek.

## Hnědé uhlí



1 – chebská pánev

2 – sokolovská pánev

3 – severočeská pánev

4 – česká část žitavské pánve



# Coal in the Czech Republic

## Exploitable Reserves of Brown Coal

Basin	Company	Mine	Exploitable Reserves		
			As of 1. 1. 2013	Life Expectancy	
North Bohemian Basin	Czech Coal Group	CSA	41,3	2017 (4,5)	2021 (3)
		Vrsany, Sverma	259,7	2044 (8)	2055 (7)
		Centrum	1,3	-	-
		<i>In total</i>	302,3	-	-
	Severoceskedoly, a. s.	Tusimice	227,2	2030 (13)	2035 (10)
		Bilina	154,4	2031 (9,5)	2036 (7)
		<i>In total</i>	381,6	-	-
Sokolovska	Sokolovska uhelna, pravni nastupce, a. s.	Jiri	142,9	2023 (5-6)	2034 (4)
		Druzhiba		2030 (4)	2034 (4)
		<i>In total</i>	142,9	-	-
<i>The Czech Republic in total</i>			826,8	-	-

Note: Exploitable Reserves in millions of tons. Life Expectancy in years, possible annual production in millions of tons in brackets.

Source: *Energostat*

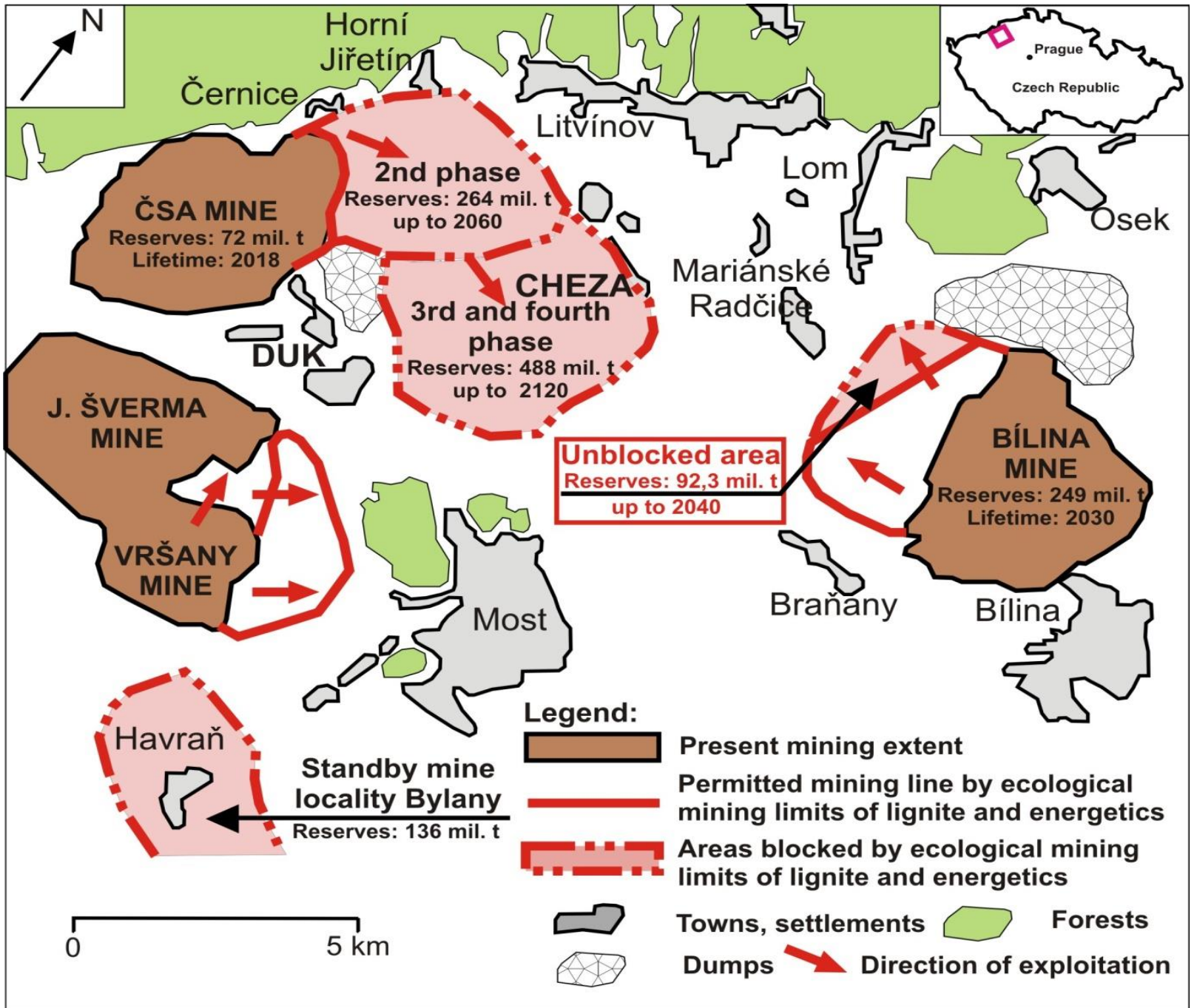
# Coal in the Czech Republic

- Coal is an essential source in the Czech energy and electricity mix
- Coal is the only energy source, in which we are self-sufficient in terms of energy security
- Domestic production of lignite fully cover domestic consumption
- Hard coal is also a major export commodity of the Czech Republic
- Current problems of the coal sector will most likely not and will not have a significant negative impact on the electricity sector of the Czech Republic, but may be at risk of inaction respective companies and industries significantly negative impact on the sector CHP

# Coal in the Czech Republic

- Two problems:
  - Financial crisis and general drop in economic production (hard coal)
  - Territorial Ecological Limits on Brown Coal Mining (brown coal)





# Limits after SEP 2015

- Decision transferred to RMP which states (p. 49):
- On 19. 10. 2015 the Government discussed the material "Further procedures and solutions for the territorial environmental limits of the brown coal mining in northern Bohemia" and issued Resolution no. 827 to tackle the issue of territorial environmental limits.
- At Bílina mine the government approved changes in the territorial environmental limits with the new mining limits set 500 m from the urban area of the nearby municipality.
- At the ČSA mine the government left the territorial environmental limits in force. But the coal will be conserved and protected and new assessment of the situation will take place in 2020, taking account the process of construction of new nuclear units.

# Financial Crisis

- At this moment the bituminous coal sector in the CR and CE is very negatively affected by the world market
- CR: drop in prices, production and closure of Paskov (31.3.2017)
- PL: drop in prices, production and significant closures, miners striking, threat of bankruptc, energy security

# Nuclear Energy in the Czech Republic



# Temelin NPP

- On August 3, 2009, CEZ, a. s. has released the announcement about opening a call for tender for two new nuclear blocks for the nuclear power plant Temelin.
- After awarded, the overall administrative tender process will last for roughly 7 to 8 years (together with the construction, 15 years), which means that the connection of new blocks is estimated for around 2024.
- The tender's finale and the signing of the contract by its winner was set at the end of 2011, in October 2010 it was, however, decided that selecting the construction works' supplier must be postponed by 2013 for unpreparedness of suppliers, which will naturally lead to the delay of the entire process.
- The function of the Government's Commissioner for the nuclear tender CEZ, a. s. was granted to Mr. Vaclav Vartuska, Special Envoy for Energy Security of the Czech Republic.
- The price was expected to CZK 200-300 billion



# Temelin NPP

<b>Technical Characteristics of the Projects Proposed by Single Nuclear Tender Applicants</b>			
<b>Company</b>	<b>Westinghouse Electric Company, LLC</b>	<b>Areva SA</b>	<b>SKODA JS, a. s., Atomstrojexport, a. s., OKB Gidropress, a. s.</b>
<b>Project</b>	AP1000	EPR™	MIR 1200 (AES 2006)
<b>Thermal capacity(MWt)</b>	3,415	4,590	3,200
<b>Electrical capacity (MWe, net / gross)</b>	1,117 / 1,200	1,590 / 1,700	1,113 / 1,198
<b>Efficiency (%)</b>	33	36	33.7
<b>Capacity factor (%)</b>	93	90.3	>98*
<b>Number of cassettes in the active zone</b>	157	241	163
<b>Number of rods in cassettes</b>	264	265	312
<b>Number of steam generators</b>	2	4	4
* Such a high value results from shorter maintenance and refueling breaks and prolonged fuel campaigns. Source: Bílý, 2011, p. 268; Company's official documents; selected and modified by T. Vlček.			

# Temelin NPP

- **Westinghouse Electric Company, LLC**

- 67 % Toshiba Corporation (67 %)
- 3 % Ishikawajima-Harima Heavy Industries Co. Ltd.
- 20 % The Shaw Group (20 %, americká strojařská společnost )
- 10 % Kazatomprom NAC (kazašská státní společnost)

- **Areva SA**

- 73,03 % Commissariat à l'énergie atomique (franc. vládou financovaná technologická výzkumná instituce)
- 10,17 % francouzský stát
- 4,82 % korejská automobilka Kia Motors
- 11,98 % další společnosti, zaměstnanci a veřejně obchodovatelné akcie

- **ZAO Atomstrojexport**

- 44 % VPO Zarubežatomenergostroj (kontrolován Federální agenturou pro jadernou energii – Rosatom)
- 6,2 % OAO TVEL (kontrolován Federální agenturou pro jadernou energii – Rosatom)
- 49,8 % OAO Gazprombanka

# Temelin NPP

- **March 2013**
- Announcement of the order of participants for tender
- 4 categories of review:

- | <u>Technology</u> | <u>Price</u> | <u>Safety</u> | <u>???</u> |
|-------------------|--------------|---------------|------------|
| AP1000            | MIR.1200     | MIR.1200      | MIR.1200   |

- **Overall:**                      **AP1000**                      **80/100 points**
- **MIR.1200**                      **66,5/100 points**

# Temelin NPP

- „While originally the project was due to the market price of electricity and other factors fully economically recoverable, today are threatened all investments into electrical energy sources, whose income depends on the sale of electricity on the open market..“ (Daniel Beneš, 10. 4. 2014)
- The price of electricity over the past 5 years decreased by 60% (4/2014 - the price of € 34/MWh, historical minimum)
- CO2 allowances are worth about 113 CZK (€ 4.2), the plan was at least 15-20 euro
- Neither the EU nor the Czech Republic at the moment does not plan to provide guarantees or stabilization mechanism for the construction of low-carbon sources (contract for difference, etc.).
- A risk that the government will require higher dividend from CEZ on their projects.
- To the construction of two units in Temelin be economically recoverable, ČEZ would need either electricity prices over 70 euros per megawatt hour (according Candole Partners least 115), or state aid.
- "CEZ is capable of doing, but it constrain all investments in other programs, which the company does not like." Václav Bartuška, government commissioner for Temelin, Hospodářské noviny, 15 June 2012

# Temelin NPP

- CEZ has concentrated on Dukovany, whose license ended in 3/2016
- CEZ would like to operate EDU until 2035, about 20 years longer

Minister of Industry Jan Mládek said that he expected that the company will announce new tender within five years.

And if everything goes well, it could be even in two to three years, said Pavel Cyrani, Director of Strategy in CEZ.



# Current situation

- ČEZ is preparing tender to allow Westinghouse to compete with TVEL for return to Temelin (23.1.2016)
- Should there be a new tender for ETE, the French will participate again (23.8.2015)
- „... Second, I believe that the decision not to declare the result of the tender was correct. If you take the construction of a nuclear power plant seriously, a tender is the last thing you should do. Nobody in the world builds a nuclear power plant on the basis of a tender and no one in this manner chooses a supplier of nuclear technology.“ (Kirill Komarov, 1st vice president of Rosatom, 25.9.2015)
- EDU received life-extension permission for operation beyond 2015 for indefinite time (31.3.2016)
- <https://www.sujb.cz/jaderna-bezpecnost/jaderna-zarizeni/jaderna-elektrarna-dukovany/dulezita-rozhodnuti-k-provozu-edu/>
- Vienna plans to ask EC for crossborder EIA

# Current situation

- National action plan for the development of nuclear energy in the Czech Republic
  - Particularly in order to maintain continuity of production in Dukovany the construction of new units in Dukovany and its launch no later than in 2037 is crucial
  - Based on the material, it is desirable to immediately start preparations for the construction of one nuclear unit at Dukovany and one in Temelin with the possibility of extending the scope to two blocks in both plants

# Current Situation (SEP 2015)

- Promote and expedite the process of negotiation, preparation and execution of the construction of new nuclear units at the existing locations of nuclear power plants with a total capacity of up to 2,500 MW (20 TWh annual production) in the period of 2030-2035 including all necessary steps.
- Create conditions for extending the life-cycle of the Dukovany NPP for 50 years, and if possible, for 60 years (with respect to technology, security, economy and EU rules).
- Target any construction of new units around the expected shutdown of EDU (ie. after 2035).



# Current situation

- National action plan for the development of nuclear energy in the Czech Republic
  - **1) investment by the owner and operator of existing nuclear power plants (CEZ) or its fully/partially-owned subsidiary (vendor)**
  - 2) investment through private group of investors (mankala model, strategic partner)
  - 3) direct construction by the state through newly established state company

# Current situation

- During the visit of Xi Jinping in the CR the China General Nuclear and Czech Energy Alliance signed Memorandum of Understanding:
- *Content: cooperation on information on nuclear power plant procurement, construction, commissioning, operation and maintenance, repair and renovation of nuclear fuel cycle facilities, the training of nuclear power plant workers and cooperating in European Utility Requirements (EUR) certification*
- *The Czech Energy Alliance was created in September 2015 and brings together, under the leadership of CEZ subsidiary Skoda Praha, 13 other leading Czech engineering companies: Alta, Doosan Ltd, Elektro Kroměříž, IBC Praha, Kralovopolska RIA, Modrany Power, MSA, Sigma Group, Skoda JS, OSC, Skoda Power, Vítkovice, ZAT and ZVVZ Group. One of the aims of the Alliance is to partner with large foreign firms in supplies for the construction of nuclear power plants.*
- *The Chinese company formally applied to EU in May 2015 for certification of the Hualong One reactor design.*

# Current situation

- 6 out of 9 approached companies replied and met Minister of Industry and Trade for consultations:
  - *Rosatom* (Russia) VVER 1200
  - *EDF* (France) EPR 1650 MWe
  - *Westinghouse* (Japan) AP1000
  - *KHNP* (Korea) APR1400
  - *China General Nuclear Power* (China) Hualong I 1080 MWe (merger of CPR-1000 and ACP1000)
  - *Areva + Mitsubishi* (France, Japan) Atmea I 1100 MWe

# Renewable Energy Sources in the CR



# Power Utility Sector Development

- How to fight the problem of aging electricity production portfolio?
- 1) Renewables and „New Way“
- 2) Boost up of the production base and „Old Way“

# Renewables

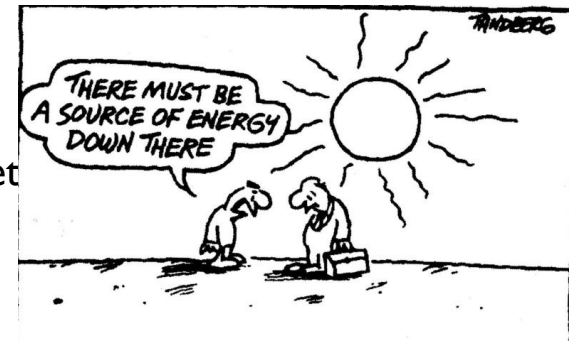
- The oldest energy sector on Earth
- vs.
- New wave of development
  - New sector, perhaps the most dynamic

## Why?



# Renewable Energy Development

- The sector responds to the global trend of combating climate change, protecting the environment, reducing greenhouse gas emissions and decrease imports of energy resources especially after 1989.
  - Rapid growth in consumption of energy resources
  - Interdependence in the relationship with foreign suppliers
  - Contradictory an effort to retain as much autonomy from foreign countries using nuclear power, domestic coal and, increasingly, renewable energy
  - First symptoms caused by lack of coal
  - Probable end of the hydrocarbon age in the 21 Century (exhaustion of coal, oil and natural gas)
  - Fighting the climate change
  - Emissions reduction efforts
  - UN and EU commitments to those organizations
  - The process of liberalization of the electricity market
  - Rising energy costs



# Renewable Energy Policies



- Two attitudes to REP:
- Low-carbon economy
  - a priori does not reject various fossil energy sources
  - the aim is to adapt the existing economy to low-carbon principle as much as possible, i.e. minimum production of CO<sub>2</sub> as the main greenhouse gas
  - this approach does not exclude (on the contrary - supports) the use and development of nuclear energy as an emission-free source
  - renewables may have different meanings, but they are always more or less complementary to the primary sources
- Environmental
  - focuses on the word "renewable" and refuses basically any fossil fuel
  - the target is complete transition to renewable energy
  - there are currently many limits for complete transition to renewable energy, such as the condition of human knowledge and technology, technical aspects and financial costs



# CZECH EXPERIENCE WITH RENEWABLES DEVELOPMENT

<b>Obligations Resulting from the Membership in International Organizations</b>	
<b>Obligation</b>	<b>Obligation as Amended by</b>
Reduction in greenhouse gas emissions by 8 % by 2012.	Kyoto Protocol
A greater renewable energy share in gross final consumption, reaching the level of 8 % by 2010 and the level of 15 % by 2030.	EU Accession Agreement (Athens, April 16, 2003)
A greater renewable energy share in gross final consumption, reaching the level of 13 % by 2020.	Directive of the European Parliament and of the Council 2009/28/EC
Reaching a renewable energy share of 10 % in all sorts of transportation displayed on gross final energy consumption in transportation in the Czech Republic by 2020.	Directive of the European Parliament and of the Council 2009/28/EC
Emissions from the sectors not covered by the EU ETS will not exceed 2005 levels increased by 9 % by 2020.	EU Climate and Energy Package
Source: T. Vlček from publicly available sources	

# CZECH EXPERIENCE WITH RENEWABLES DEVELOPMENT

- Act No. 180/2005 Coll. pioneered the term '**green bonus**', indicating "the financial amount increasing the market price of electricity that is paid by the operator of the regional grid system or the operator of the transmission system to the producer of electricity from renewable sources, taking account of reduced damage to the environment resulting from use of a renewable source compared to combustion of fossil fuels, of the type and size of the production plant and of the quality of electricity supplied"
- It obliges the operators of the regional distribution systems and the operators of the transmission system "to **purchase all electricity from renewable sources** eligible for promotion and to conclude a supply contract, if a producer has offered electricity from renewable sources".
- „Assumption of responsibility for deviation pursuant to special regulation" is of extreme importance as well, as the responsibility was put on CEPS for **maintaining the stability** of the network in the event of unstable production of electricity from renewables.


**Tab. 7.4: Scenario of Renewable Energy Share in Final Energy Consumption According to the National Renewable Energy Action Plan of the Czech Republic**

<b>Year</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>Share ( %)</b>	6.1	6.2	7.0	7.0	7.4	8.3	<i>9.4</i>	<i>10.1</i>
<b>Year</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
<b>Share ( %)</b>	<i>10.8</i>	<i>11.3</i>	<i>11.8</i>	<i>12.1</i>	<i>12.5</i>	<i>12.9</i>	<i>13.2</i>	<i>13.5</i>

Note: data in italics are figures planned according to the Scenario, while other figures represent actual levels.

Source: The Ministry of Industry and Trade, 2010d, p. 88.

- The system of state promotion of renewables was set so generously that, for example, the target of 1,695 MWe of installed capacity in photovoltaic power plants, which the Czech National Renewable Energy Action Plan set for 2020, has been exceeded already in 2010.
- The cause of this boom lies in a combination of reduction of investment costs in photovoltaic and wind power plants construction on one hand and excessively high preferential treatment through state support on the other hand, which led to a significant development of the renewable sector and proliferation of companies engaged in installation of domestic and industrial power plants.
- While in 2005 the purchase price of electricity from photovoltaic power plants was 6.04 CZK/kWh, the Energy Regulatory Office more than doubled this value in 2006, to 13.2 CZK/kWh (which is about twelve times the market price of electricity)

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- An originally well-planned program was supposed to motivate citizens to accept renewables, to bring them to trust in their potential and also to increase renewable energy share in total production and consumption of electricity in the Czech Republic, in order to accomplish the required commitments resulting from international agreements.
  - In reality, however, the citizens and industry sector identified the opportunity and prospect of easily obtainable and guaranteed state money in the course of several years, while photovoltaic plants, consequently, experienced an incredible expansion.
  - Not even the Energy Regulatory Office was capable to manage the situation, since the law allowed it to lower a purchase price of electricity from renewables by maximum 5 % per year.

**Tab. 7.8: Installed Capacity of Photovoltaic Power Plants in the Czech Electrification System**

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
Inst. capacity	0.13	0.13	0.74	3.4	54	464.4	1,959.10	1,971.0	2,086.0

Note: data always as of December 31. Installed capacity indicated in MWe.

Source: Energetický regulační úřad.

- It is clear that it was impossible to react on this unexpected and unanticipated development of photovoltaic (and wind) power plants in a timely manner by developing the technical base of electrification systém.
- The „Renewable Energy Crisis“ was de facto triggered by the mentioned discrepancy and it erupted on February 16, 2010, when the companies CEZ Distribuce, a. s. and E.ON Distribuce, a. s. met the request of CEPS, a. s. and stopped with the approval of applications for installation of new photovoltaic and wind power plants into the network.
- The stop of approvals lasted until September 2011, and than again from January 2012 until the end of the year in Southern Bohemia and Southern Moravia.


# Renewables

## Total Expenditures for Photovoltaic and Wind Power Plants in the Czech Electrification System in the Period 2010 – 2030

Gross Costs	In Total 2010 – 2030 (mil. of CZK)	Share of Total (%)
Direct costs of electricity purchased in photovoltaic power plant	509,916	72.6
Direct costs of electricity purchased in wind power plant	44,836	6.4
Costs of the provision of sufficient PpS	48,948	7.0
Costs of induced investments	18,035	2.6
Costs of additional regulatory energy	80,380	11.4
In Total	702,116	100


Source: Zajíček, 2010, p. 66; modified by T. Vlček.

- In November 2010, Amendment No. 330/2010 Coll. and, in December 2010, Amendment No. 402/2010 Coll. to Act No. 180/2005 Coll., on the promotion of electricity production from renewable energy sources and amending certain acts, were passed and entered into force on March 1, 2011.
  - state would from now on support only those photovoltaic power plants connected to the distribution network
  - So called solar farms will be also cut of support, whereas the state support will go only to the photovoltaic power plants placed on roofs and buildings with installed capacity of no more than 30 kWp
  - So called retroactive solar tax of 26-28% was introduced for all photovoltaic facilities launched in 2009 and 2010
  - In 2011, a purchase price of electricity from renewables was set on 7.5 CZK/kWh.

- 
- These amendments were understood as a temporary solution
  - A new act entered into force on January 1, 2013, as Act No. 165/2012 Coll. on supported energy sources
  - The Act was closely tied to Directive 2009/28/EC.
  - According to the National Renewable Energy Action Plan, the connection of renewables into the network will be, from now on, capped with a yearly deliberate capacity.
  - Even though Directive 2009/28/EC understands the levels of the National Action Plan as minimum, the new Act No. 165/2012 Coll. understands them as maximum.
  - These caps are, according to the National Action Plan, calculated every year not only for the entire Czech Republic, but for single regions as well. Should they reach the upper limit, no further connection approvals would be granted until the following year.
  - Support of photovoltaic power plants is recently limited to the production capacity of less than 30 kWp that is located on the roof or perimeter wall of one building attached to the ground via firm foundations registered in the real estate registry.





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- The amendments and the new act contributed to the stabilization of the renewable sector.
  - The price to be paid is, naturally, high. A rough suspension of the sector and a significant change of terms led to the bankruptcy of tens of companies trading with photovoltaic technologies, while the state is financially burdened with support to decentralized production and renewables for the next tens of years.
  - Renewables were depreciated in the public eyes to a great measure and the likelihood that the obligation of a 13 % renewable energy share in gross final energy consumption by 2020 will be accomplished is very low.
  - In 2004, production of electricity from renewables reached the figure of 2.61 TWh and a 3.80 % share in consumption.
  - In 2012, production of electricity from renewables amounted to 8.06 TWh, while the share in consumption was 11.43 %.
  - In this relation, it depends on the point of view whether we really speak of positives figures.

# Price of electricity

- Why this boom affects the overall price of electricity?

<b>Share of price components for electricity supply to households in 2010 and 2014</b>		
Electricity incl. margin	42,27 %	30 %
Market operator	0,12 %	0,2 %
<b>System services of ČEPS</b>	<b>3,94 %</b>	<b>2 %</b>
<b>Renewables, cogeneration and decentralized sources</b>	<b>4,41 %</b>	<b>10 %</b>
<b>Electricity distribution and transport</b>	<b>31,86 %</b>	<b>40,2 %</b>
Ecological tax	0,72 %	0,6 %
VAT	16,67 %	17 %
Source: Energetický regulační úřad		

# Renewable Energy Policies

The development of contribution to the RES, CHEP and DS for end consumers

Year	2009	2010	2011	2012	2013	2014	2015	2016
Contribution in CZK per 1 MWh	52,18	166,34	370,00	419,22	583,00	495,00	495,00	495,00

# Renewable Energy Policies

- 26.7.2013 – approval of the amendment of the current law on renewable energy sources (another amendment in March 2016)
- Content:
- 1) capping the contribution to RES at 495 CZK / 1 MWh (positive effect on competitiveness)
- 2) end of support for new sources and distributed generation of electricity (biomass, bioliquids and biomethane, solar power, biogas stations) since 1. 1. 2014
- Support stopped since 1. 1. 2015 also to installations, which will have authorization to be build at the time the act entered into force
- 3) end of the aid will not cover high-efficiency combined heat and power production, secondary sources of energy, and the heat produced from renewable sources

# Renewable Energy Policies

- In the current centralized arrangement of electricity (and heat production) in the Czech Republic, RES can never be more than just complementary
- Rearranging of the system would of course lead to changing the potential use of RES
- Renewable energy sources are and will be in the Czech Republic for a long time only supplementak sources, their development has been artificially and rudely stopped
- It should be rigorously separated the different types of renewable energy sources, because each has different characteristics in terms of production, distribution, resource base, networking, etc.
- This fact can not be viewed quite negatively
  - sharply dialectical nature of the current energy sector aims to increase the use of renewable energy sources
  - attention should be given to headlessness and irrational support (biomass)
  - we should target areas where the resource base is almost for free (eg. waste)
  - we should support and conceptually and rationally develop projects based on geographic and national specifics of appropriate conditions and those that have future potential



**Thank you for your attention!**

**Questions?**