

# European Energy Market 7

## Cost of Electricity

Studia niestacjonarne II stopnia

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# Components of electricity cost

- Total cost of electrical energy consists of four main components:
  1. **Capex** – cost of investment calculated for a unit of production MWh
  2. **Opex** – operation & maintenance (O&M)
  3. **Fuel**
  4. **CO2** - allowances for CO2 emission

# Weighted Average Capital Cost WACC

Loan	7
Equity	10,5
Leverage	0,7
WACC	8,05

# Costs in the construction period

		Coal		
Year	Annual cost %	Loan %	Interest %	Total %
1	20	20	1,6	
2	20	40	5,0	
3	20	60	10,2	
4	20	80	17,4	
<b>5</b>	<b>20</b>	<b>100</b>	<b>26,9</b>	<b>127</b>

	Coal			
Year	Loan to payback	Interest	Loan	Annual instalment
1	127	10,2	4,6	14,9
2	122	9,8	5,0	14,9
3	117	9,4	5,4	14,9
4	112	9,0	5,9	14,9
5	106	8,5	6,3	14,9
6	100	8,0	6,8	14,9
7	93	7,5	7,4	14,9
8	85	6,9	8,0	14,9
9	77	6,2	8,6	14,9
10	69	5,5	9,3	14,9
11	59	4,8	10,1	14,9
12	49	4,0	10,9	14,9
13	39	3,1	11,8	14,9
14	27	2,2	12,7	14,9
15	14	1,1	13,7	14,9
<b>Total</b>	<b>0</b>			<b>222,9</b>

**Paying back  
investment  
cost for 20  
years loan  
period**

# Input data

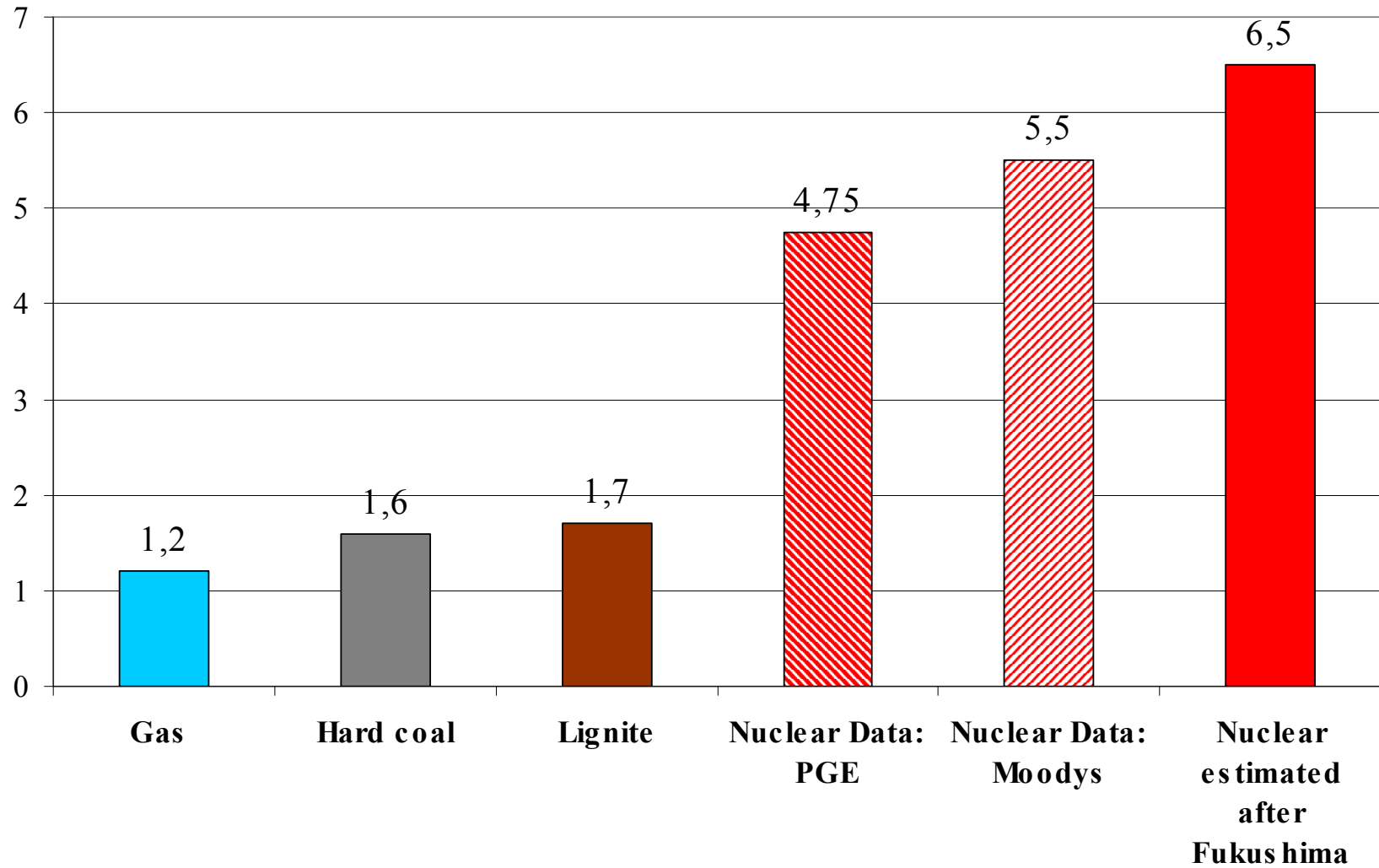
	Gas	Węgiel	Atom		
				PLN/Euro	4,2
				PLN/USD	3,3
Construction cost in Billion Euro/GW	1,2	1,6	4,75	Opex for nuclear in USD/MWh	40
OPEX in zł/MWh	32	35	132	Opex for nuclear in zł/MWh	132
Fuel in zł/MWh	157	104	49,5	Fuel for nuclear in USD/MWh	15
Koszty CO2 w Euro/Mg - obecne	8	8	8		

# Categories of investment costs

- **Procurement Cost** is the cost of acquisition of goods or services.
- **TURN-KEY COSTS.** Those necessary expenditures that are incurred before a product or project is ready for use.
- **Overnight Cost** is the cost of a construction project if no interest was incurred during construction, as if the project was completed "overnight."



### Investment cost in billion Euro/GW



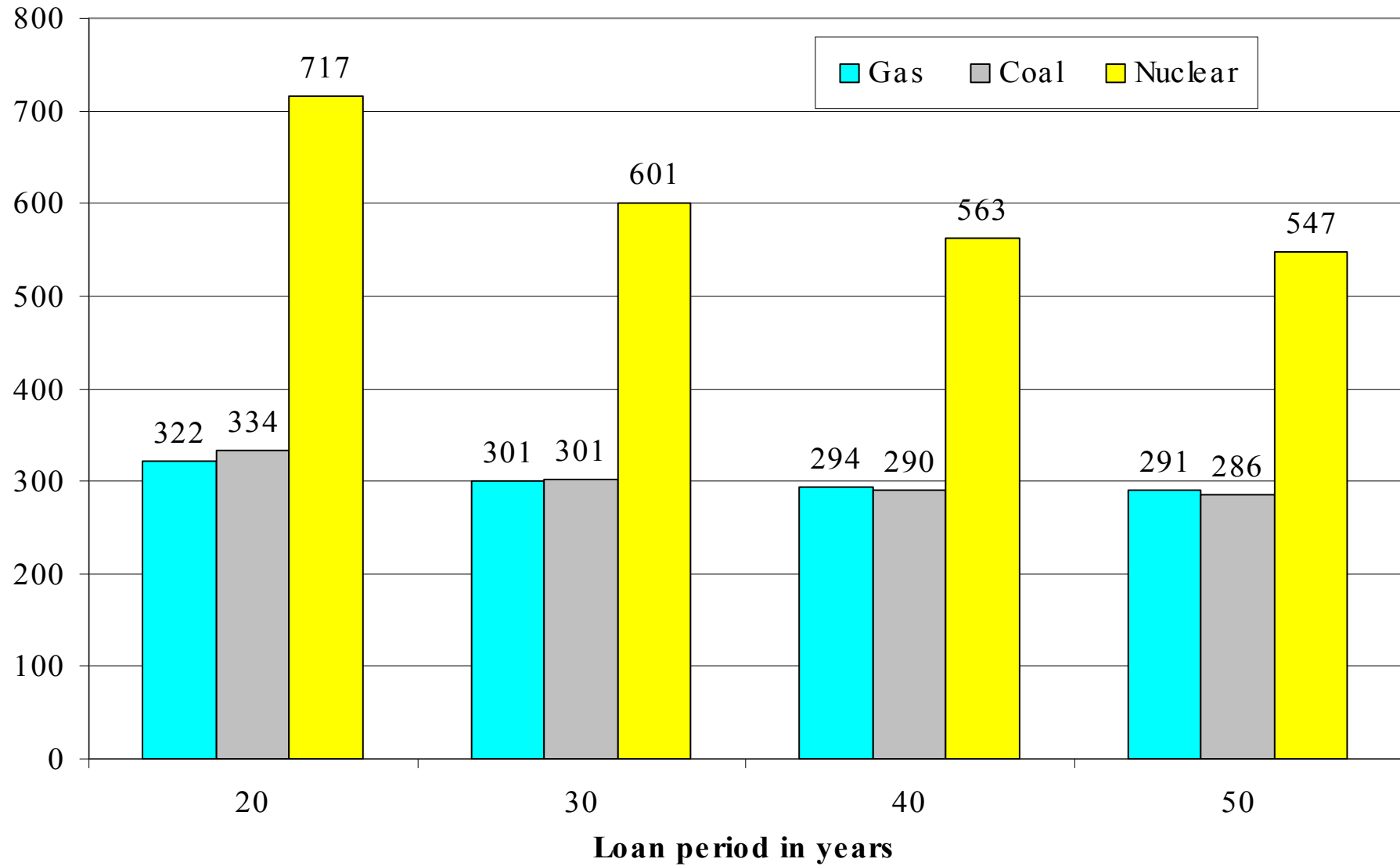
# Capex calculation

- If 1000MW costs 1,6 billion Euro, then 1MW cost 1 600 000 Euro
- Annual instalment is 14,9% so annual cost of 1 MW =  $1\ 600\ 000 * 14,9\% = 220\ 800$  Euro per year
- Generator works 6000h per year so it will produce 6000MWh
- Cost per energy unit is  $220\ 800$  Euro/6000MWh = 40Euro/MWh

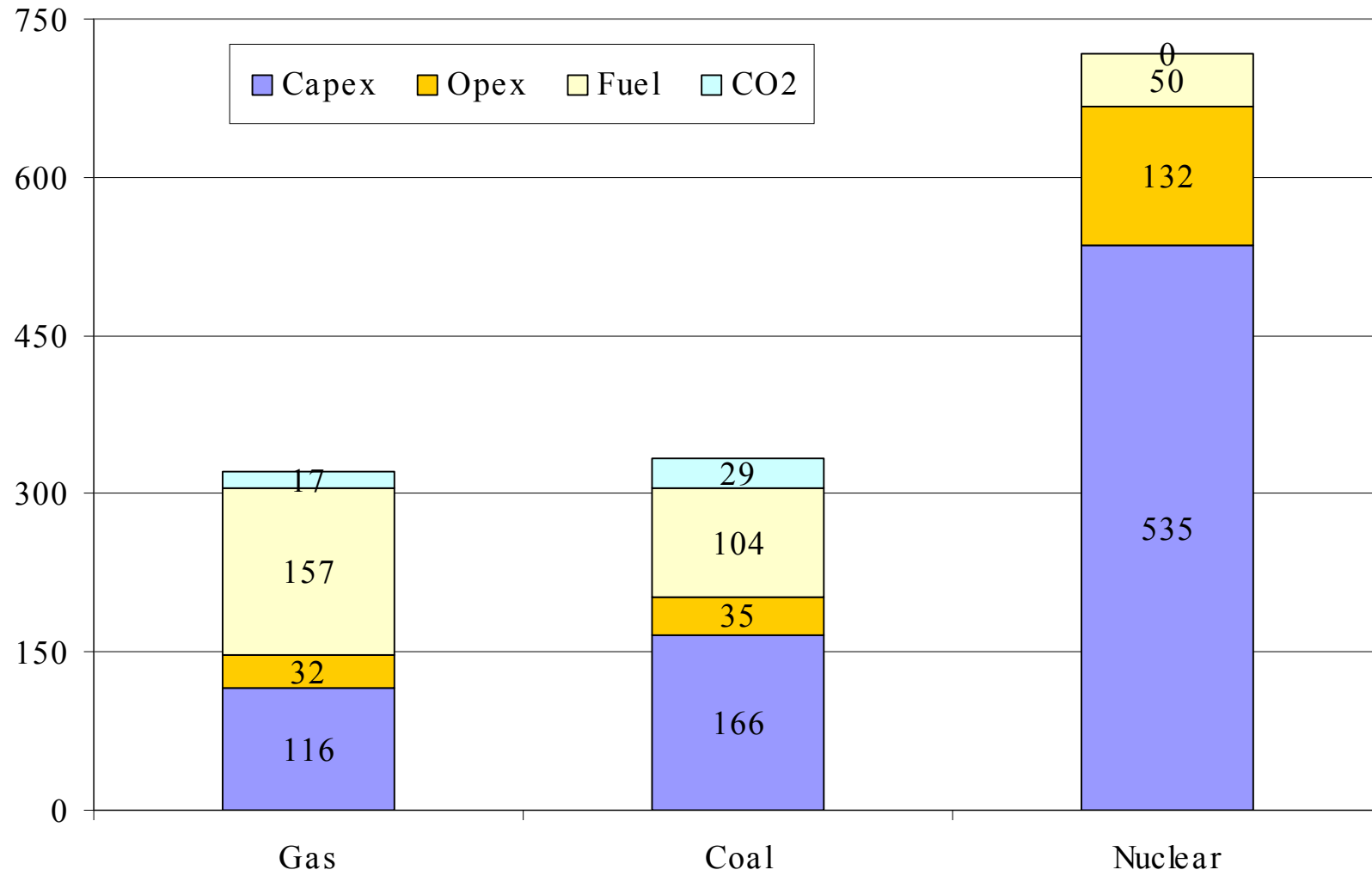
Gas	Loan period in years				
	20	25	30	40	50
Loan instalment	13,8	12,2	11,3	10,5	10,1
Capex for 1MWh w Euro	28	24	23	21	20
Capex for 1MWh in PLN	116	102	95	88	85
Opex in zł/MWh	32	32	32	32	32
Fuel in zł/MWh	157	157	157	157	157
Total in PLN/MWh without CO2	305	291	284	277	274
<b>Option 1 - Current CO2 cost</b>					
Cost CO2 in PLN/MWh	17	17	17	17	17
Total cost zł/MWh	322	308	301	294	291
<b>Option 2 - CO2 cost for competitive nuclear</b>					
	98	83	75	68	65
Cost CO2 zł/MWh	412	349	317	286	274
Total zł/MWh	717	641	601	563	547

## Cost calculation

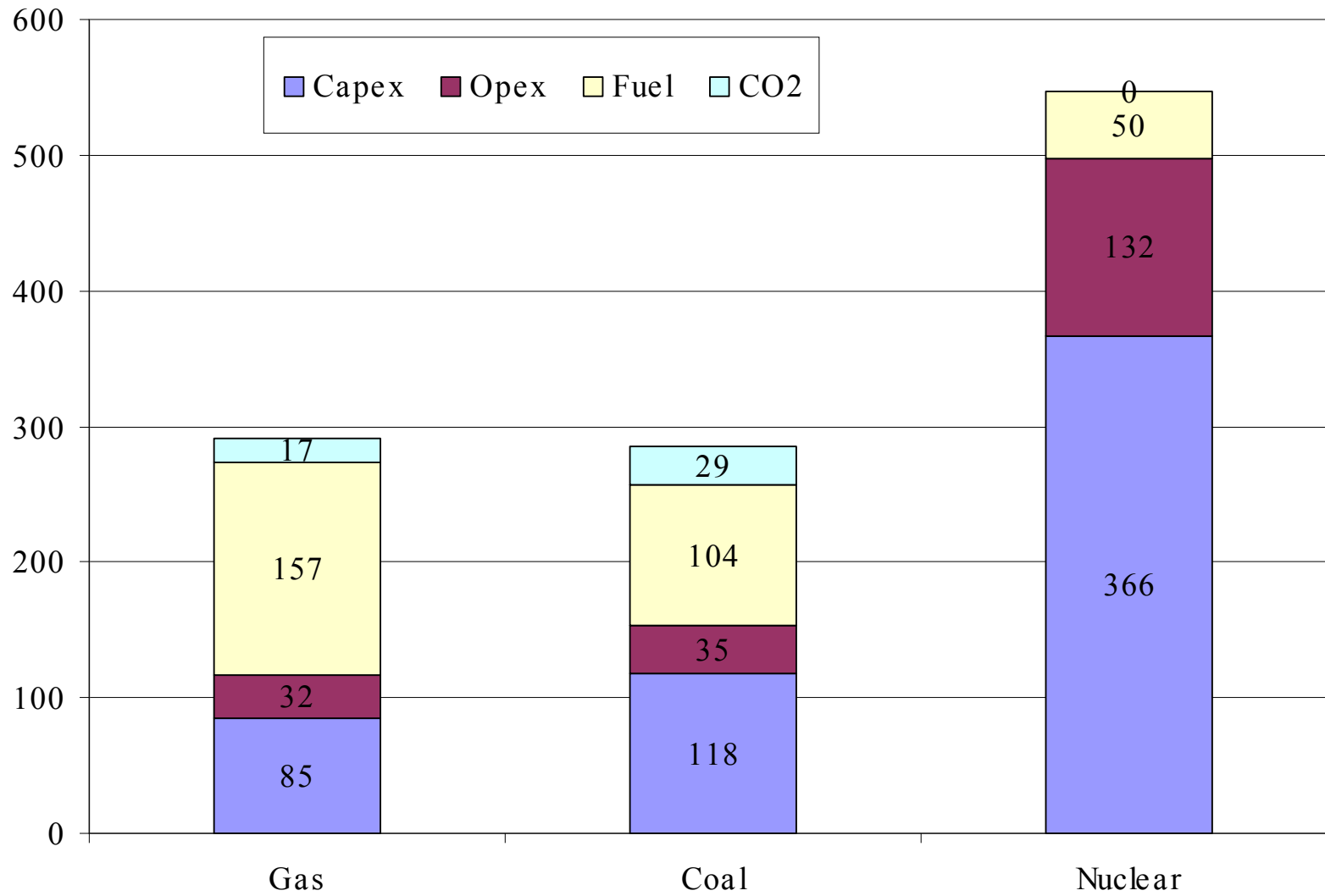
## Electricity cost as function of loan period



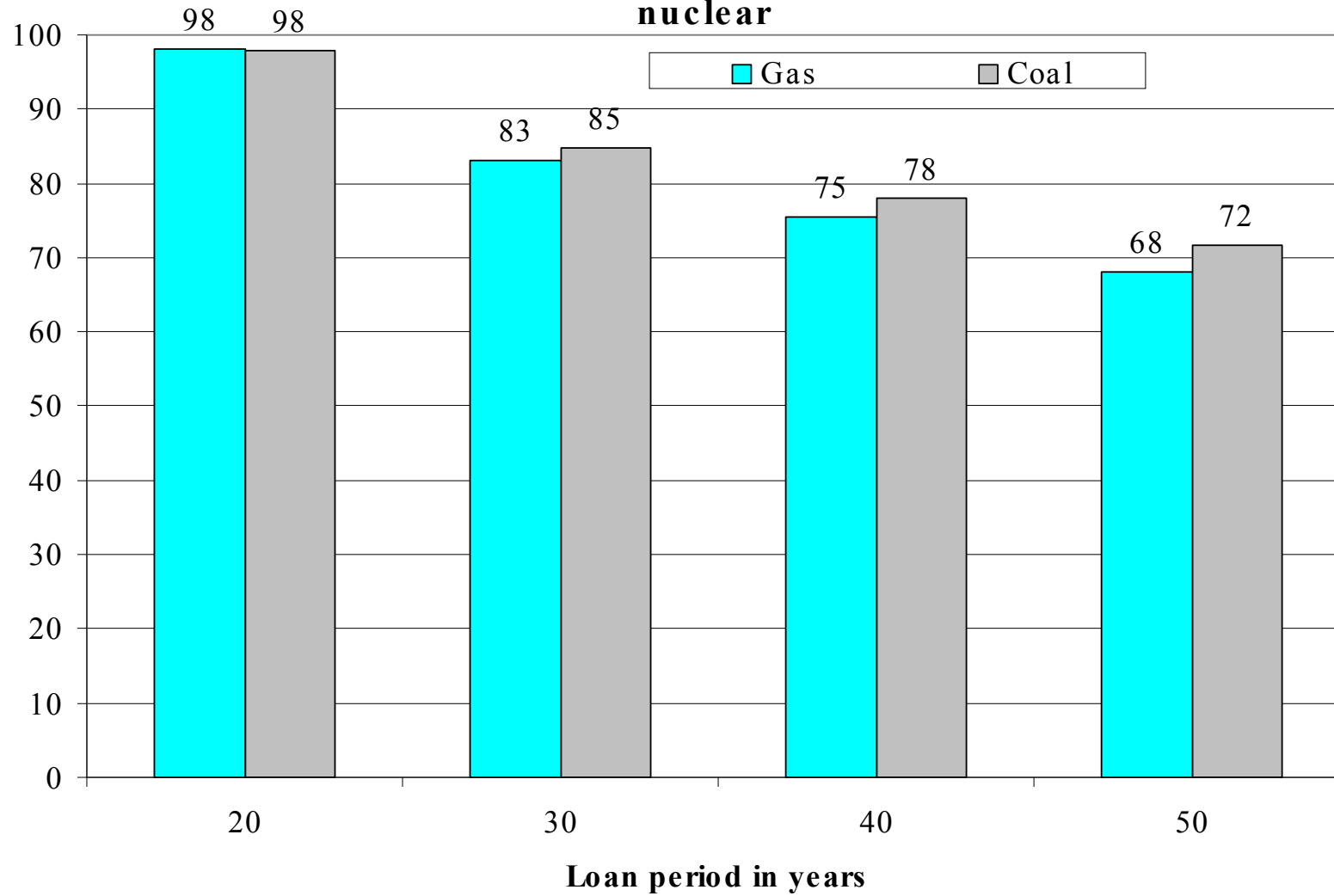
**Cost components in zl/MWh for loan period 20 years**



**Cost components in zł/MWh for loan period 50 years**

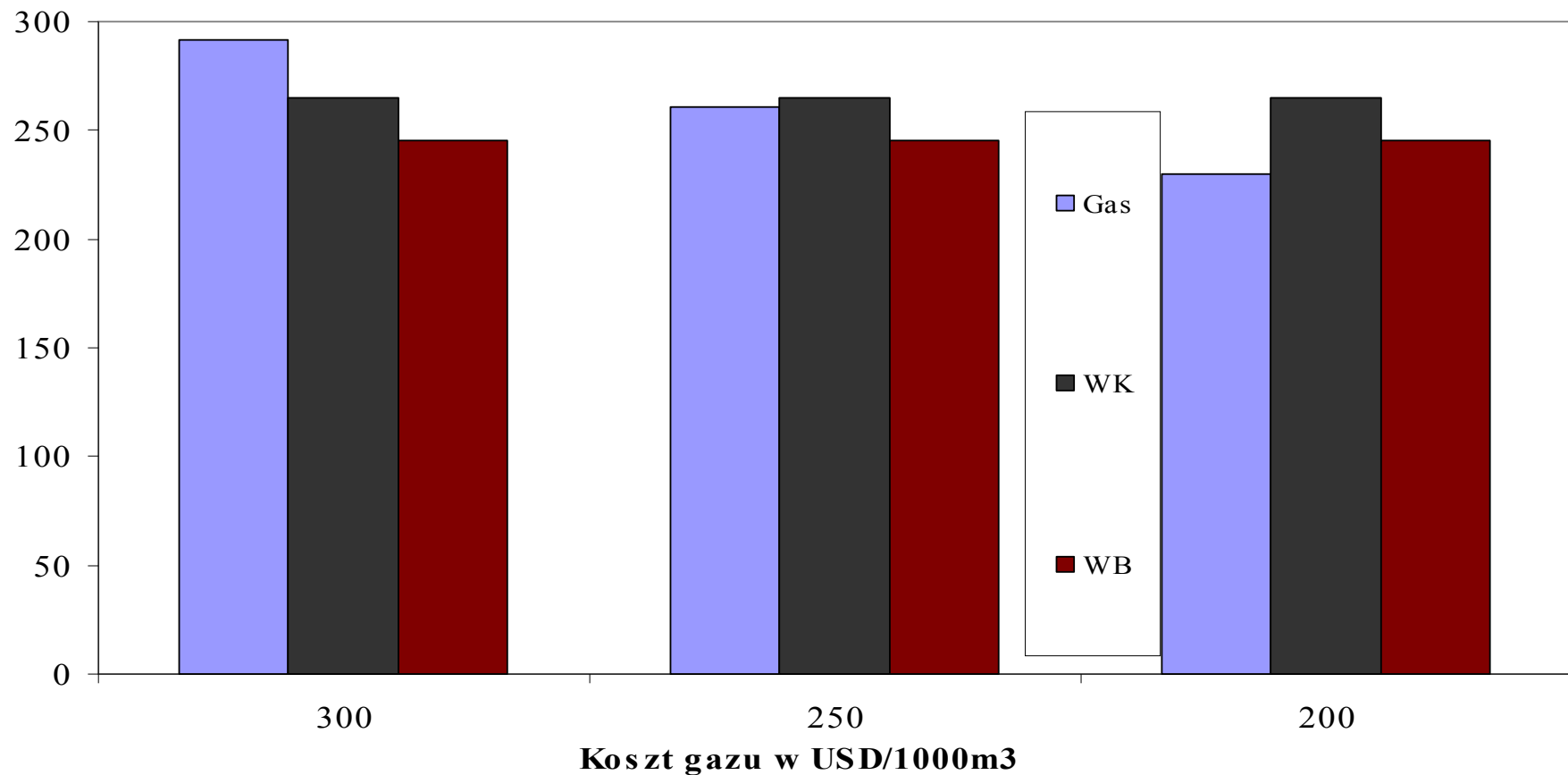


### Cost of allowances for CO2 emission in Euro/Mg for competitive nuclear



# Competitive gas prices

Cost of energy production in function of gas prices for base operation





# **Additional materials**

- **This lecture is companioned by two additional files:**
- **Electricity cost calculator in Excel format**
- **Electricity cost calculator Manual**
- **Both files are sent separately to lecture files or can be found in Internet – see the page**

# Further reading

- More information relating to cost of electricity can be found at:  
<http://www.prezentacje.cire.pl/st,42,285,item,66047,1,0,0,0,0,0,prezentacja-koszty-energetyki-jadrowej.html>
- There are three files:
- Presentation on electricity cost
- Manual for electricity cost calculator
- Electricity cost calculator