



# KEY APPROACHES TO THE COSTS ASSESSMENT COSTS OF BAT IMPLEMENTATION IN ENERGY GENERATION

*Dr Olga Kondratyeva, Head of Department for Environmental Engineering and OHS,  
Moscow Power Engineering Institute*

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# EMISSION REDUCTION INVESTMENT AND COST CALCULATION (ERICCA\_LCP)

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## OBJECTIVE

Cost assessment for  
LCP emission  
reduction

## BASELINE DATA

- Data on operational and intended emissions
- Technical characteristics of power installations
- Measures for emission reduction and their technical characteristics
- Economic Data



**COST ASSESSMENT FOR  
BAT TRANSITION OF  
ENERGY-GENERATING  
SECTOR**



**COMPILING A LIST OF  
ENERGY INSTALLATION  
NON-COMPLIANT WITH  
BAT**



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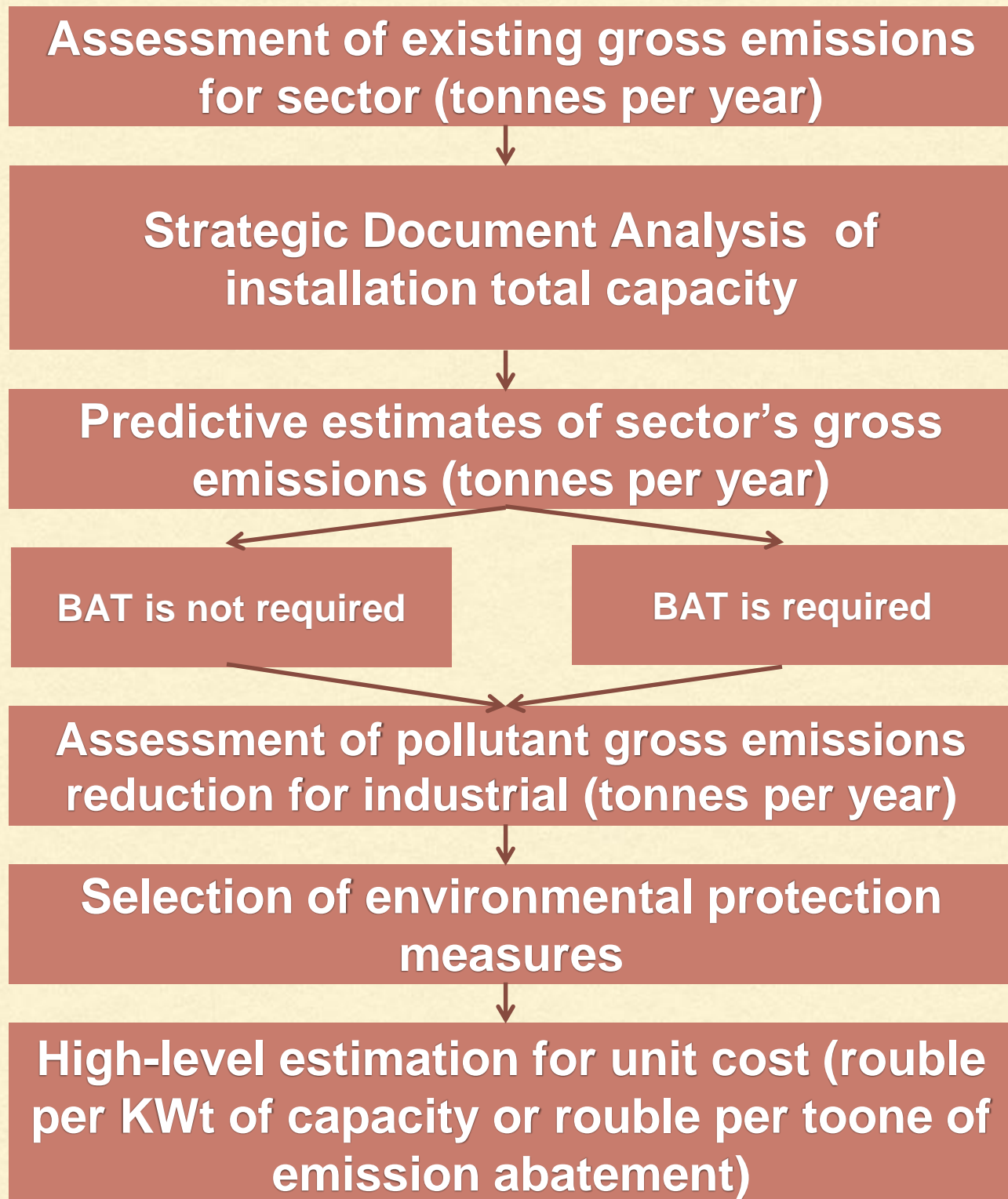
# BASELINE DATA

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- Composition and total amount of operational emissions
- Operational pollutant ELVs
- BAT-AELs
- List of pollutants requiring emission reduction
- Reference values for CAPEX and OPEX to install environmental protecting technology per 1kWt of total capacity (rouble per kWt) or reference values of unit cost factor for decreasing emissions per 1 tonne (rouble per tonne)

# APPROACH 1

## CALCULATION ALGORITHM



Order by the Ministry of Energy of the Russian Federation №143, 01.03.2017 "On adopting scheme and programme for development of Unified energy system for 2017-2023."

? **Compiling a list of energy installation non-compliant with BAT**



# APPROACH 2

## CALCULATION ALGORITHM

Gathering and processing of baseline data



Defining operational concentrations in LCP emissions



Compiling a list of energy installation non-compliant with BAT by comparing operational concentrations with technological parameters



Defining required emission abatement level



Selection of comprehensive BAT list



High-level cost estimation



Using CAPEX on emission abatement equipment (rouble per kWt of capacity)



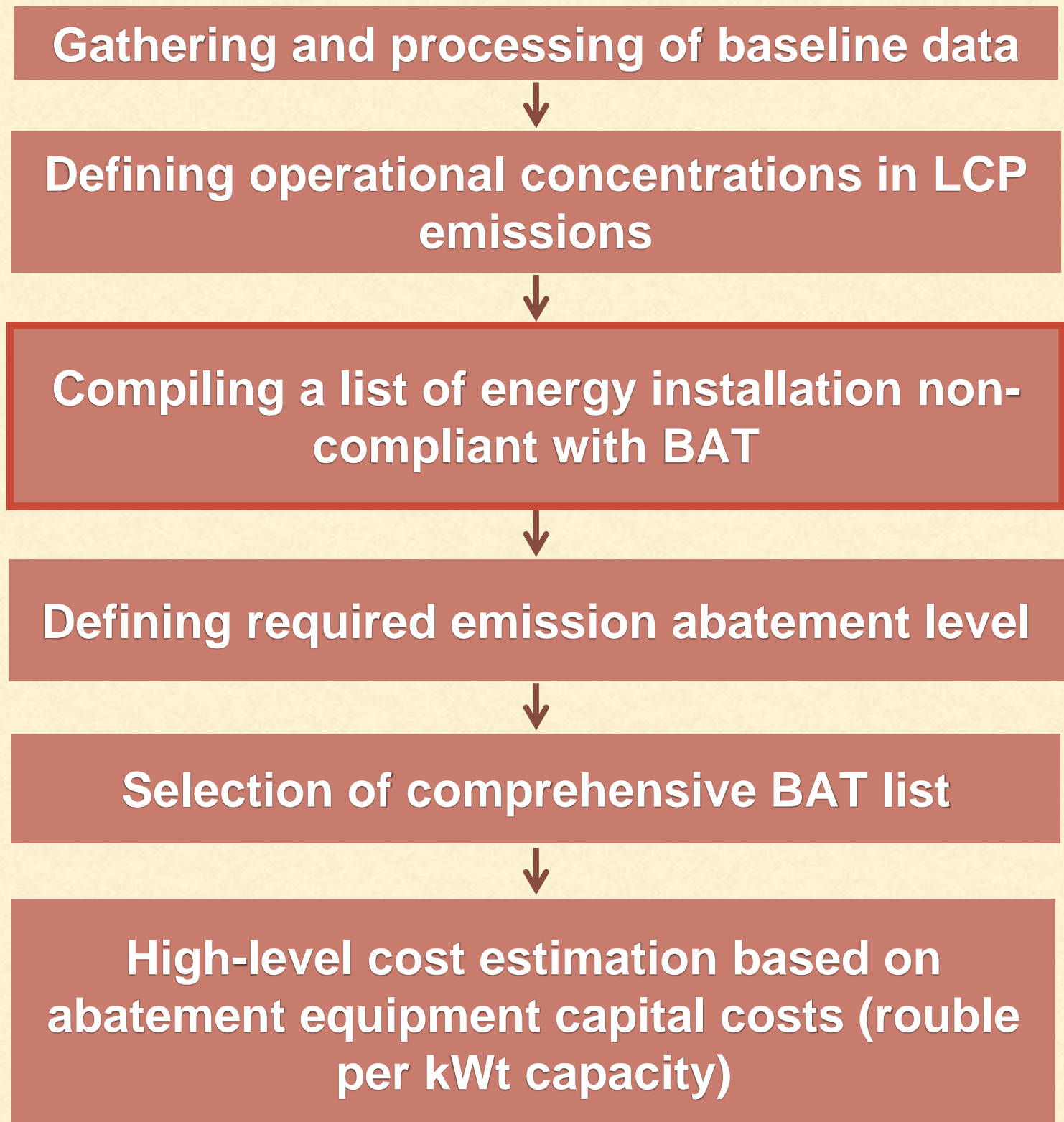
Using cost factor for emission abatement per 1 tonne (roubles /tonne)

**?** Data from 100 % installations is required

# APPROACH 3

## CALCULATION ALGORITHM

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# BASELINE DATA ANALYSIS

Category	Number of energy installations		
	Natural gas	Solid fuel	Total
I	49	48	<b>97</b>
300 list	5	33	<b>38</b>
II	140	40	<b>180</b>

	Installations non-compliant with BAT			
	Solid particles	SO <sub>2</sub>	NO <sub>x</sub>	Total
Natural gas	-	-	24	<b>24</b>
Solid fuel	42	9	1	<b>52</b>



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# DEVELOPING REPRESENTATIVE SAMPLING

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## *Stratified sample method*

Amount of representative sampling:

$$n = \frac{t^2 \bar{\sigma}^2 N}{t^2 \bar{\sigma}^2 + \Delta_x^2 N}$$

Where  $t = 1,96$  – standardized deviate with confidence coefficient 95%;

$\bar{\sigma}^2$  - average variance within groups;

$N$  – universe parent population;

$\Delta_x = 5\%$  - margin of sampling error;

# DEVELOPING REPRESENTATIVE SAMPLING

Fuel type	Commissioning year	Pollutant						
		SO <sub>2</sub>		NO <sub>x</sub>			Solid particles	
		Степень очистки, %						
		Up to 40	41 and higher	Up to 30	31-50	50 and higher	Up to 30	30 and higher
Solid Fuel	Before 31.12.1981	2	-	-	-	-	6	3
	After 01.01.1982	2	-	-	-	-	4	4
Natural Gas	Before 31.12.1981	-	-	1	2	-	-	-
	After 01.01.1982	-	-	3	1	1	-	-
Total		4	-	4	3	1	10	7



# USING CAPEX ON EMISSION ABATEMENT EQUIPMENT

Technique	Potential NOx emissions abatement, %		CAPEX, rouble/kWt		Implementation time, months		OPEX, kop/ kWt·h	
	min	max	min	max	min	max	min	max
Flue gas recirculation	10	20	20	70	0,5	3	0,6	1,2
Two-stage combustion	20	45	70	140	2	3	-	-
Three-stage combustion	25	50	100	200	2,5	4	6	9
Low emission burners	30	40	60	200	2	4	-	-
SNCR	30	70	900	1500	12	15	6,6	9

# USING CAPEX ON EMISSION ABATEMENT EQUIPMENT

Technique	Collection Efficiency of Solid particles, %	CAPEX, rouble/kWt		Implementation time, months		OPEX, kop/ kWt·h	
		min	max	min	max	min	max
Electrofilters	99,5	1080	2200	12	18	1,2	1,5
Electrofilters	99,75	1300	2700	12	18	1,5	1,8
Electrofilters	99,9	1600	2900	12	18	1,8	2,3
Emulsifiers	99,5	320	540	10	16	0,9	1,25
Wet Venturi Scrubbers	98,5	290	470	10	16	0,18	0,6
Bag Filters	99,9	1700	2800	12	18	9,6	13,8



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# THANKS FOR YOUR ATTENTION

Contacts:

Dr Olga Kondratyeva, Head of Department for  
Environmental Engineering and OHS, Moscow Power  
Engineering Institute

[KondratyevaOYe@mpei.ru](mailto:KondratyevaOYe@mpei.ru)

+7 (495) 362-72-46

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