Air protection technologies

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Presentation scope

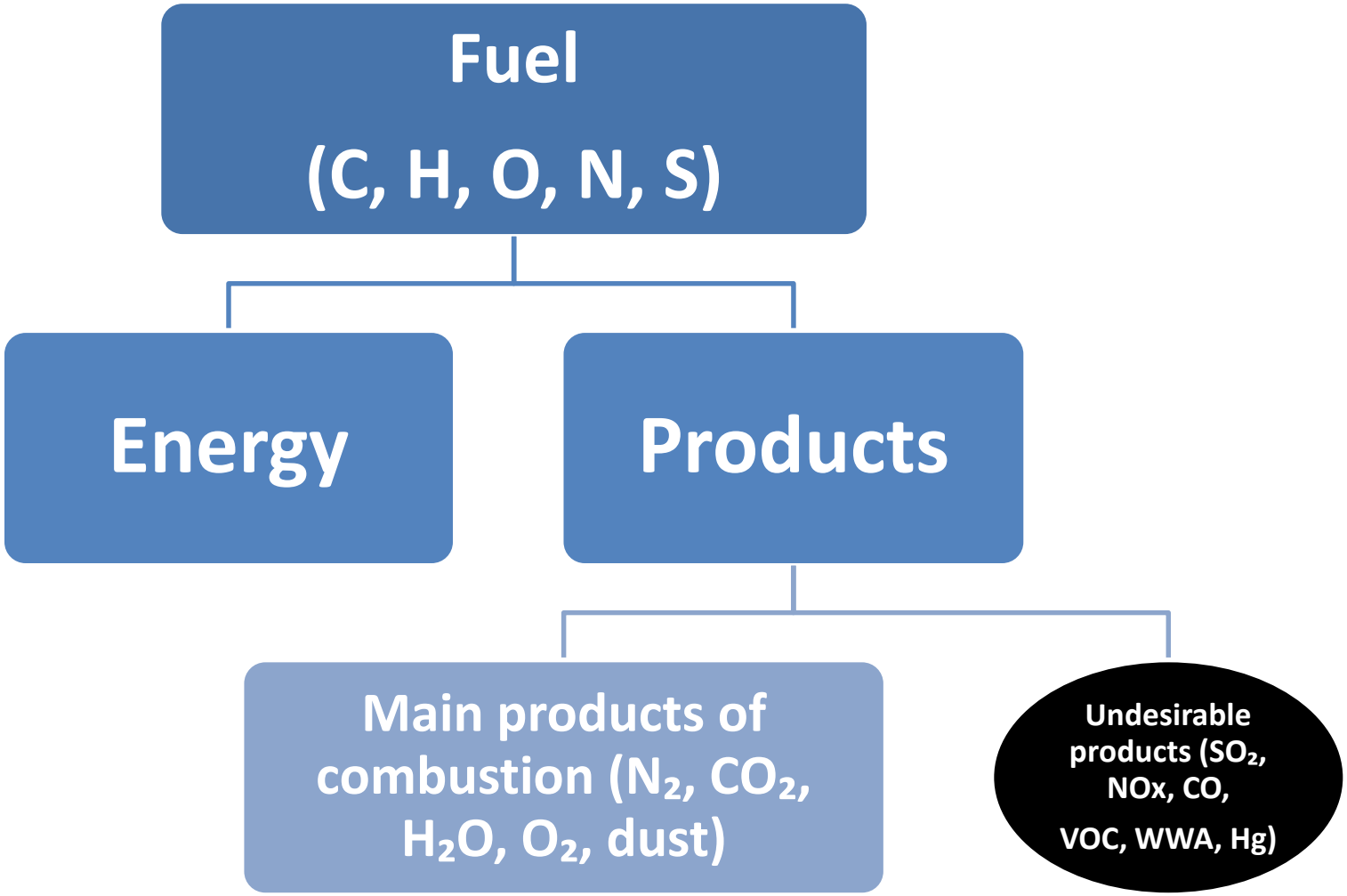
Introduction
- Fuel combustion – reactants and products
- World primary demand
- Electricity generation by source
- Air pollution emission by sector

Law & Regulations
- BAT and IED - emission limits of pollution
- BAT - efficiency of gas and coal technologies
- Installations of flue gas cleaning

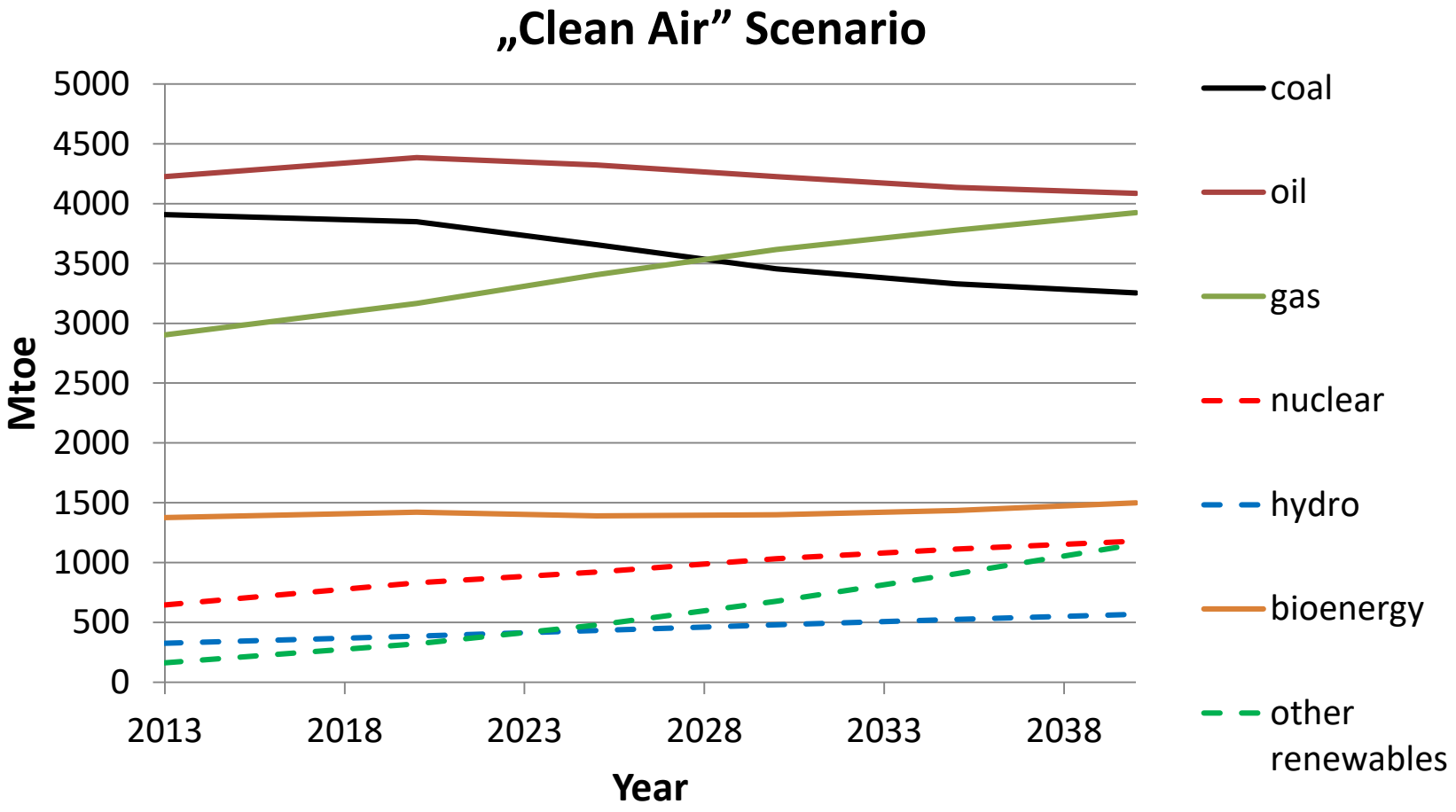
CO_2 emission
- Buildings
- Electricity generation
- Electromobility

Conclusion
- Summary

Introduction

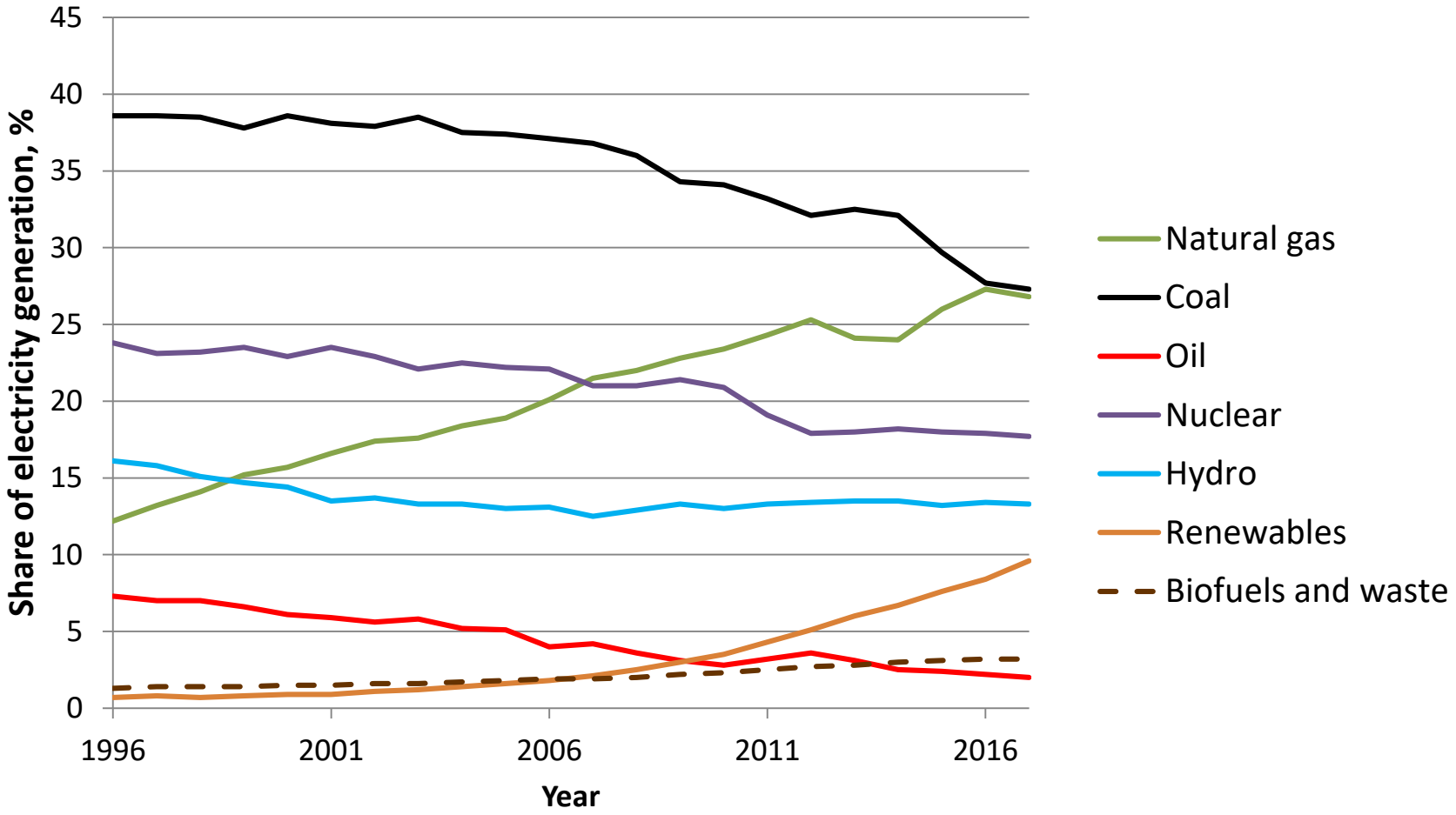


World primary energy demand



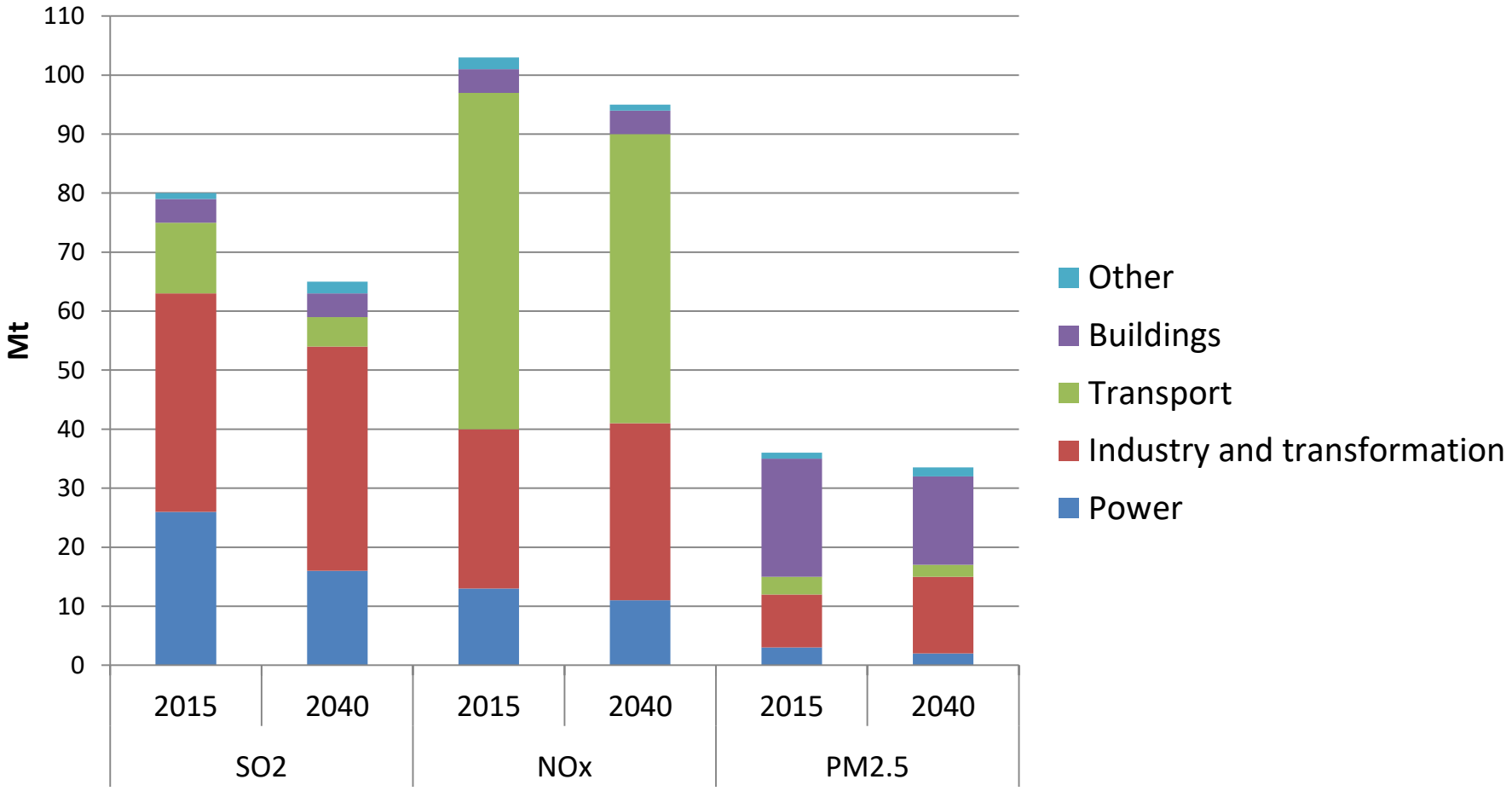
Source: *International Energy Agency, Energy and Air Pollution, 2016*

Electricity generation by source



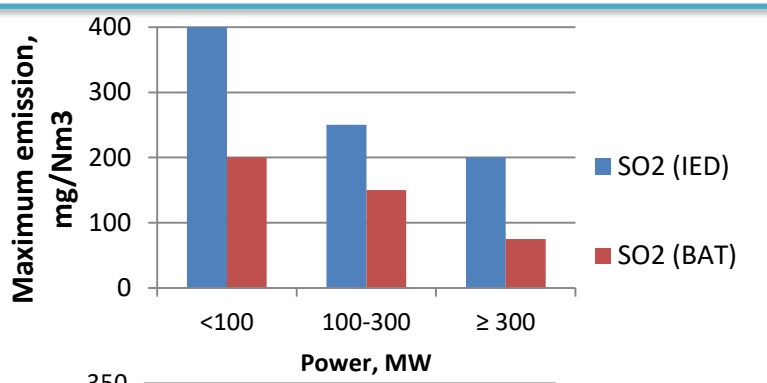
Source: *www.iea.org/statistics/electricity/*

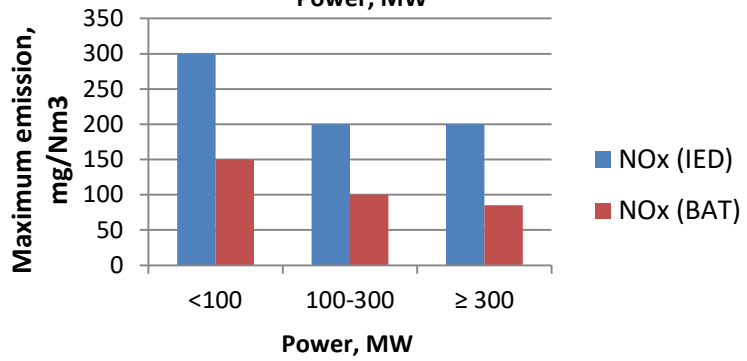
Global air pollutant emissions by sectors

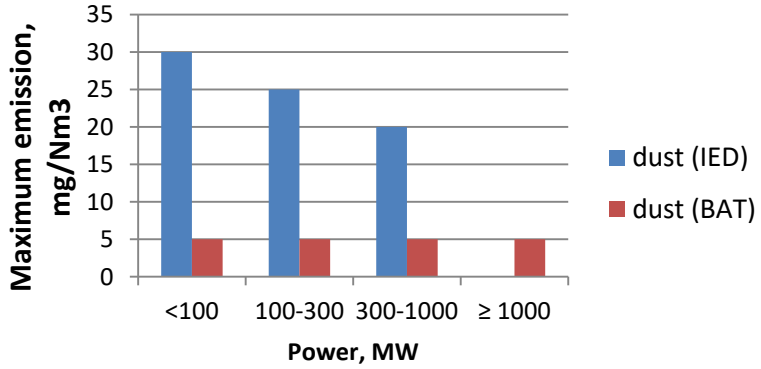


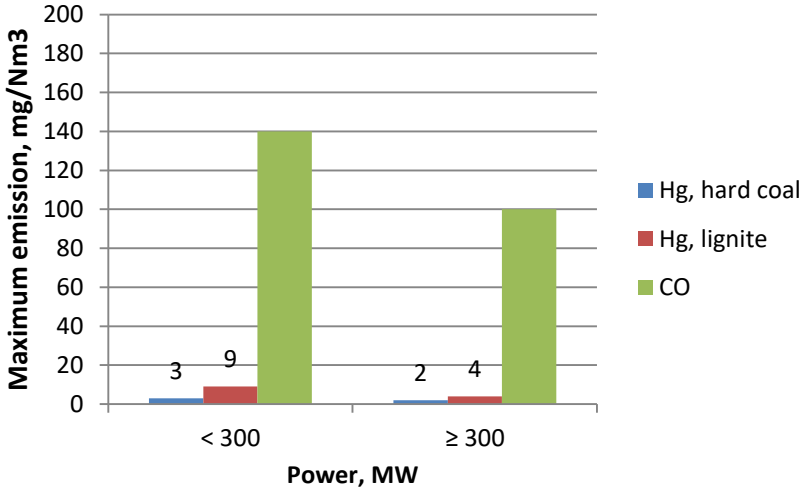
Source: *IEA, Energy and Air Pollution, 2016*

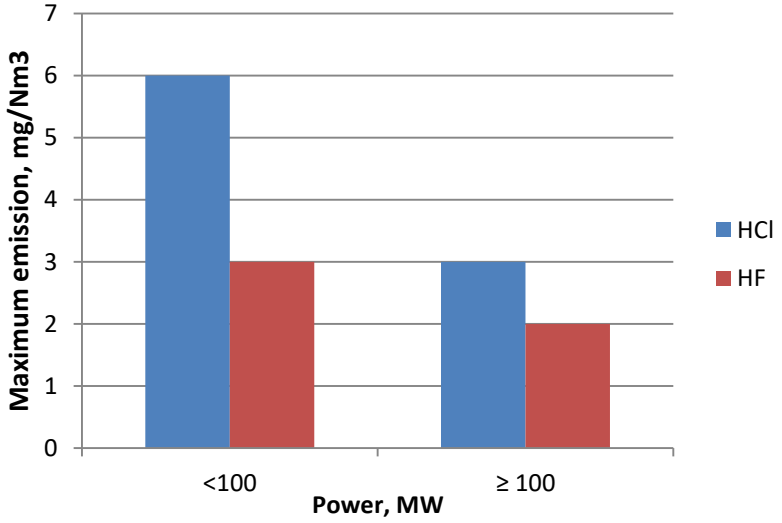
Emission limits according to IED and BAT for new power plants











Source: *www.mos.gov.pl*

Efficiency of different flue gas cleaning systems

Pollutant	Technology	Location	Efficiency, %
SO_2	Wet flue-gas desulfurisation	End-of-pipe	70-98
	Spray-drier absorption	End-of-pipe	50-70
NOx	Low and ultralow-NOx burners	Integral to combustion process	20-30
	SCR	End-of-pipe	90
	SNCR	End-of-pipe	<50
$PM_{2.5}$	Fabric filtration	End-of-pipe	>99
	Electrostatic precipitators	End-of-pipe	>99

Sources: *Nalbandian-Sudgen, H.: IEA Coal Centre (2006) and IEA analysis*

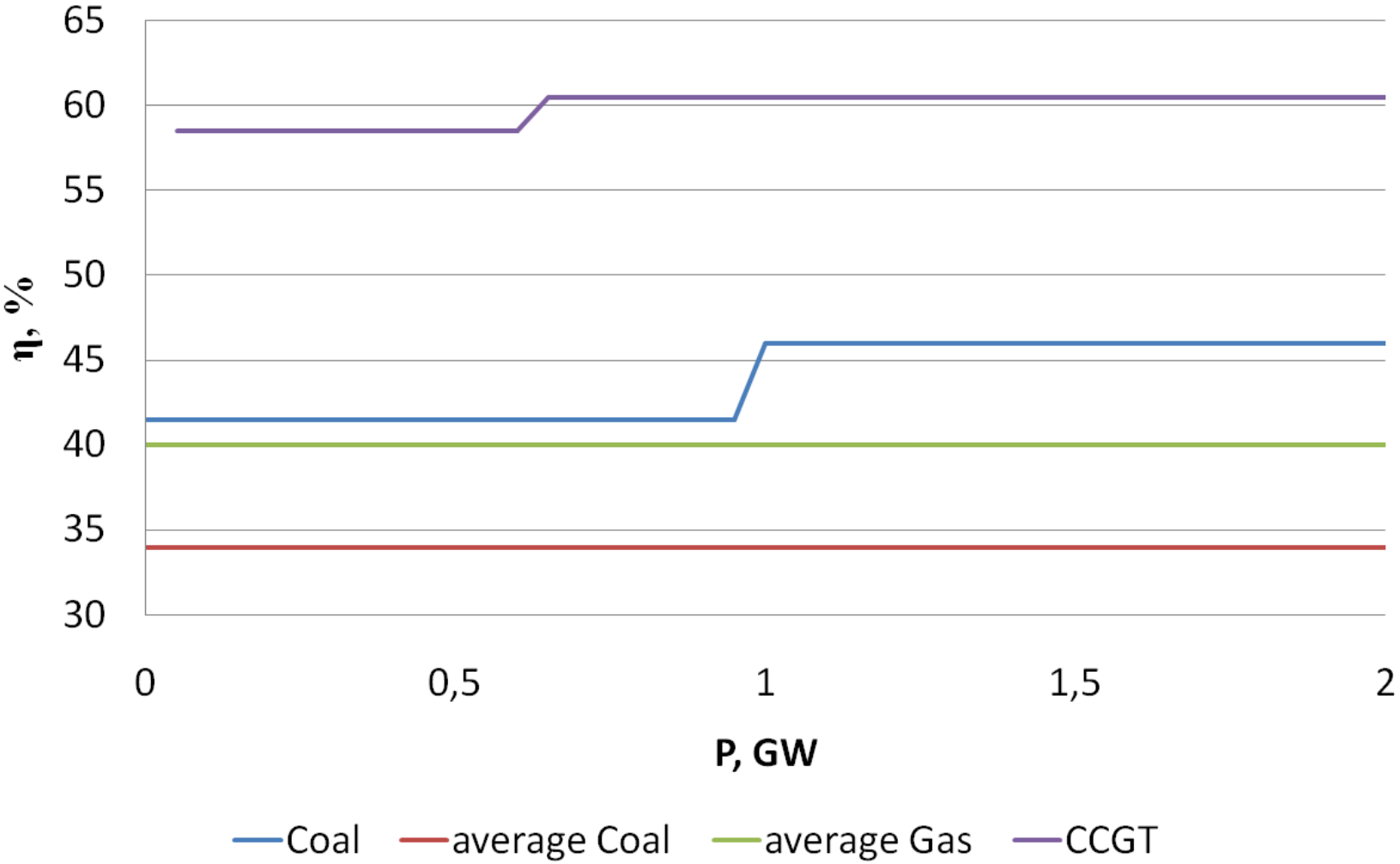
Isogo Thermal Power Station

- **Location:** Japan
- **Output:**
No. 1 Unit: 600 MW
No. 2 Unit: 600 MW
- **Gas discharge volume (wet gas):**
No. 1: 2 000 000 Nm³/h
No.2: 1 992 000 Nm³/h

	Desulfurization		Denitrification		Dust precipitator	
Unit	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
Type of removal system	Dry system		Selective Catalytyc Reduction		Electrostatic precipitator	
Reagent	Active Carbon Absorption Process		Ammonia		-	
Efficiency, %	95.0	97.8	87.5	91.9	99.94	99.97
Emission, ppm	20	10	20	13	10	5

Sources: *Isogo Thermal Power Station brochure - AECEN*

Efficiency of different technologies according to BAT and average market values



Sources: www.mos.gov.pl, *IEA: Energy Efficiency Indicators for Public Electricity Production from Fossil Fuels*

CO_2 emission – buildings

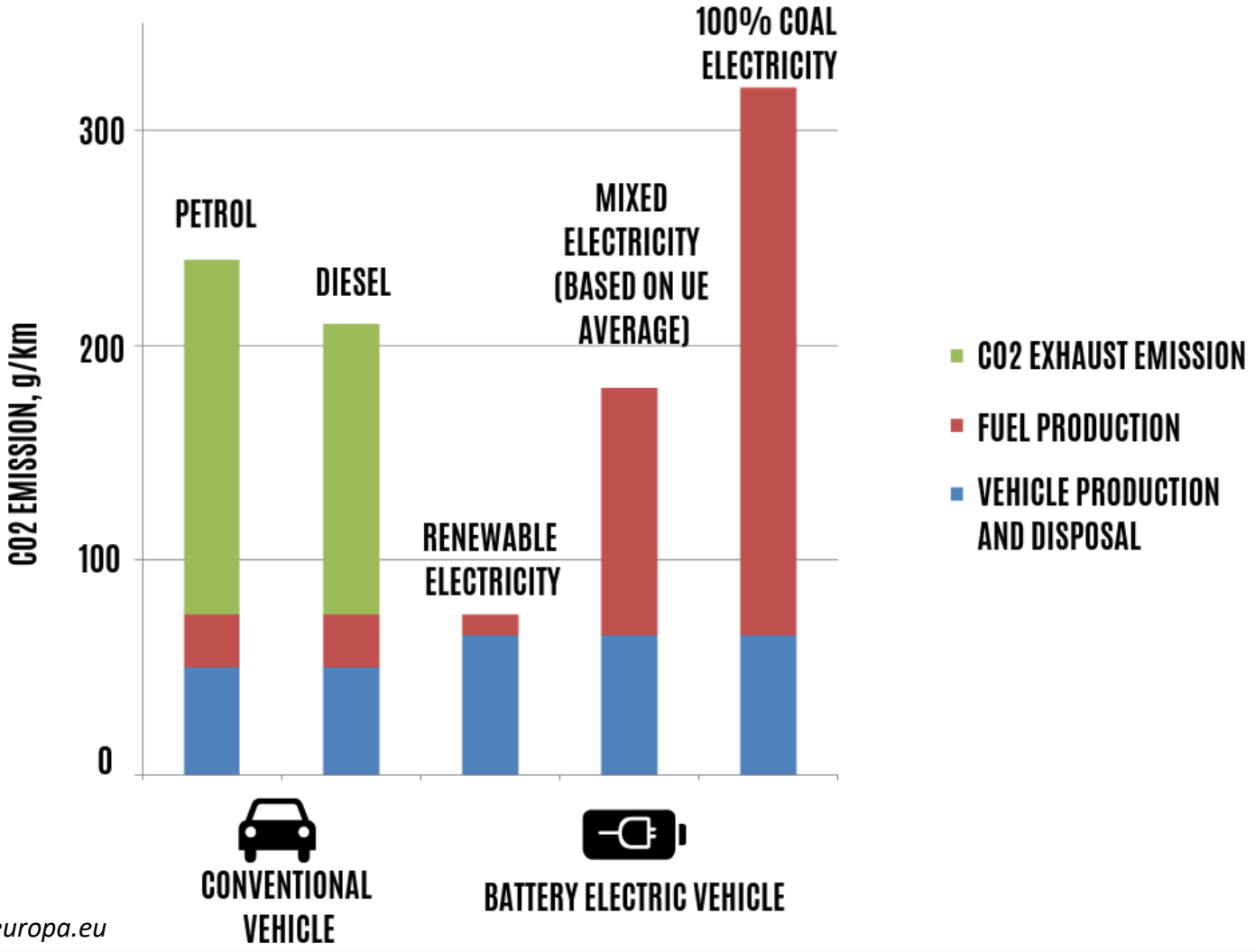
	Standard building	Energy-saving building
Demand for the final energy of the building, kWh/(m² · year)	150	50
Carbon dioxide emissions by heat source, kg CO_2/(m² · year)		
Coal	61.05	20.35
Gas	37.80	12.60
Heat pump	30.45	10.15
District heat	55.40	18.47
Electricity	121.80	40.60

CO_2 emission – electricity generation

Energy source	Standard emission factor, g CO_2/kWh	LCA emission factor, g CO_2/kWh
Coal	886.8	975.3
Gas	477.9	607.6
Wind energy	0	9.7-123.7
Solar energy	0	53.4-250

Source: *Varun, I.K. Bhat, Ravi Prakash: LCA of renewable energy for electricity generation systems—A review, Renewable and Sustainable Energy Reviews (2009)*

CO_2 emission – electromobility



Source: *www.eea.europa.eu*

Conclusion

Challenges for sustainable development:

- Change of lifestyle and habits
- Rational consumption of electricity
- Increased use of renewable energy sources
- Increase in the efficiency of electricity generation and distribution
- Electromobility development