Gothenburg Protocol

Attainability of the emissions levels for Poland based on National projections

Preliminary Assessment

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Scenarios – Baseline conditions

- Simplified emission scenarios (**SCEN-1, SCEN-2, SCEN-3**) for Poland [EnergSys, 2011], were build for preliminary assessment of the possibility of achieving emissions levels in 2020, set in NEC#7 Report [IIASA, 2010]
- In this presentation projected emissions were compared with scenarios calculated in CIAM 1/2011 report

SCEN-1	Emissions projections based on energy and fuels demands according to „National Energy Policy until 2030" (**POL2030**)
SCEN-2	Emission projection developed to meet the requirements of the IIASA (NEC#7) baseline scenario **P09 (CLE)**
SCEN-3	Emission projection developed to meet the requirements of the IIASA (NEC#7) scenario **P09 (TSAP)**

No official POL national projections This scenarios were developed to meet NEC#7 scenarios requirements – **not based on planed activity for each sector until 2020**

SO2 – emission scenarios

ALL	• Nuclear energy in 2020 • coal quality improvement for domestic sector and manufacture industry (S cont.~0.6%)
SCEN-1	• deSOx (~95% efficiency) for 70% energy and heat production sector and increase deSOx efficiency for 40% of the largest LCP • 30% of coal consumption decrease for domestic sector (substitute coal for gas)
SCEN-2	• deSOx (~95% efficiency) for 70% energy and heat production sector • 60% of coal consumption decrease for domestic sector (substitute coal for gas)
SCEN-3	• deSOx for 95% installations (brown coal) 85% (hard coal) and increase deSOx efficiency for 40% of the largest LCP • 75% of coal consumption decrease for domestic sector, 60% of coal consumption decrease for other industry activities (substitute coal for gas)

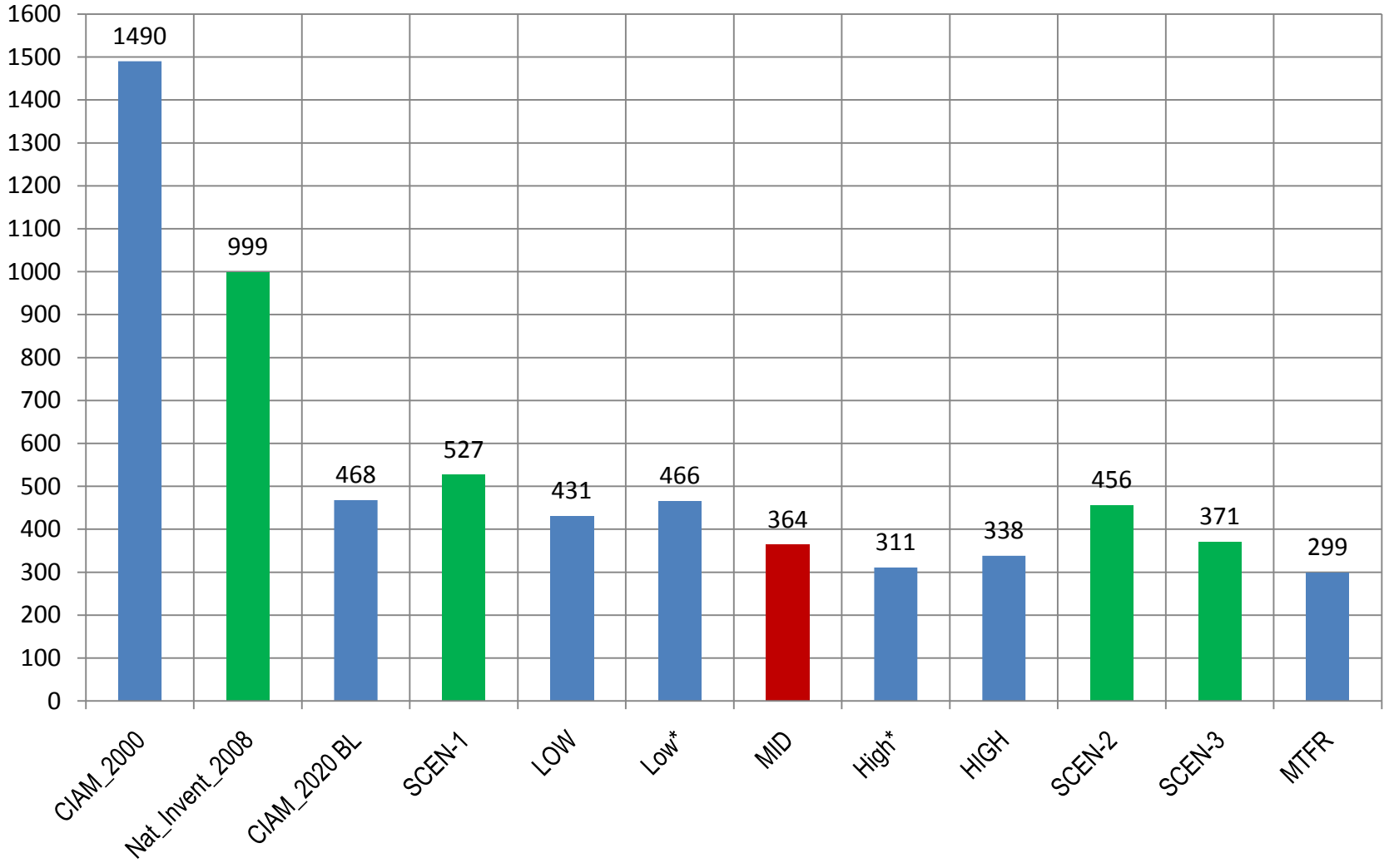
Reductions calculated according to 2008 emissions inventory data

SO2 – National Inventory 2008

SNAP	SO2	
	[kt]	%
01. Combustion in production sector and energy transformation	**572,5**	57,33
02. Combustion in municipal and residential sectors	**229,6**	23,92
03. Combustion in industry	188,12	18,11
04. Production processes	5,13	0,46
07. Road transport	1,03	0,12
08. Other mobile sources and machinery	0,53	0,05
09. Waste treatment and disposal	0,07	0,01
TOTAL	**998,6**	

Source: National Emissions Inventory 2008 [KASHUE-KOBiZE 2010]

SO2 in Poland 2020 [kt]– scenarios comparison



[Based on EnergSys 2011]

NOx emission scenarios

SCEN-1	• SCR (~85% efficiency) for 55% el. energy plants • ~10% emissions reduction from road transport (16% increase of fuel demand until 2020, all old vehicles replaced)
SCEN-2	• SCR (~85% efficiency) for 95% of all el. energy plants and 80% of all cogeneration plants • ~10% emissions reduction from road transport (16% increase of fuel demand until 2020, all old vehicles replaced)
SCEN-3	• SCR (~90% efficiency) for 95% of all energy plants and 80% of all cogeneration plants • ~35% emissions reduction from road transport (all old vehicles replaced, energy/hydrid vehicles)

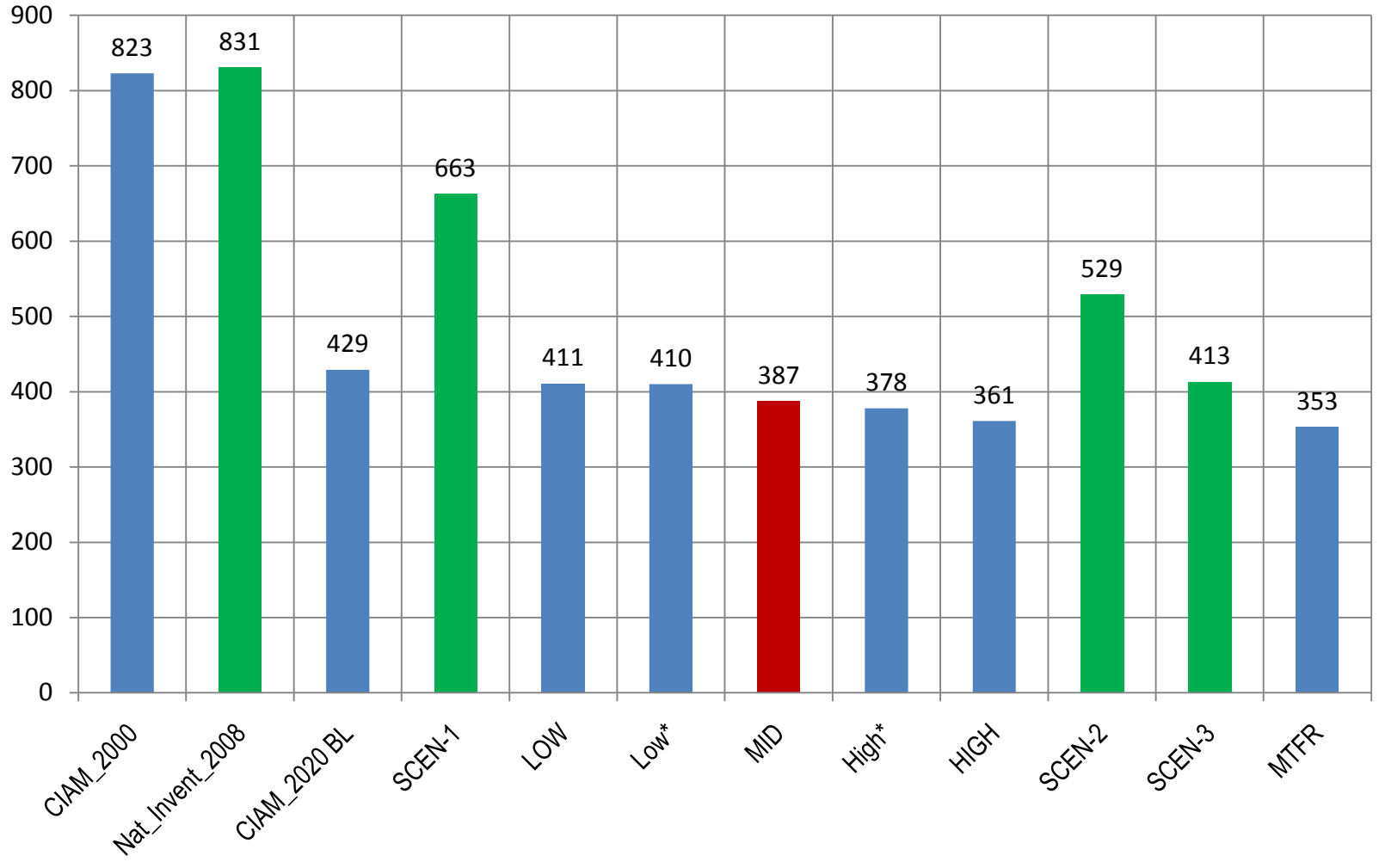
Reductions calculated according to 2008 emissions inventory data

NOx – National Inventory 2008

SNAP	NOx	
	[kt]	%
01. Combustion in production sector and energy transformation	**274,0**	**32,97**
02. Combustion in municipal and residential sectors	82,3	10,28
03. Combustion in industry	111,3	12,06
04. Production processes	21,0	2,27
07. Road transport	**249,3**	**30,83**
08. Other mobile sources and machinery	99,3	11,33
TOTAL	**831,2**	

Source: National Emissions Inventory 2008 [KASHUE-KOBiZE 2010]

NOx in Poland 2020 [kt] – scenarios comparison



[Based on: EnergSys 2011]

PM2.5 – Emission scenarios

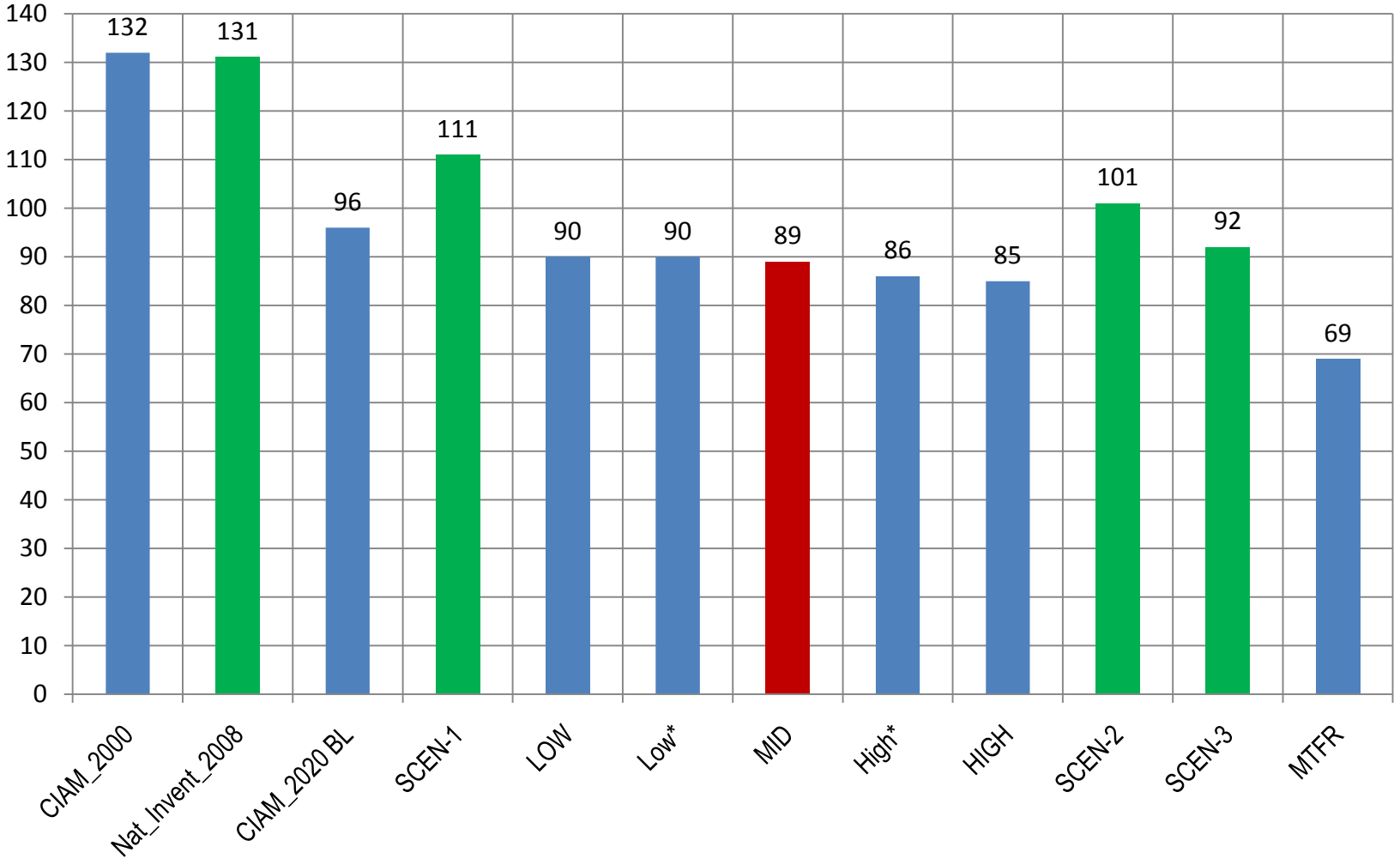
SCEN-1	• 15% of emission reduction (substitution of coal for gas)
SCEN-2	• 23% of emission reduction – incl. 60% coal consumption decrease for domestic sector (substitution of coal for gas)
SCEN-3	• 27% emission reduction – incl. 80% coal consumption decrease for domestic sector (substitution of coal for gas)

PM2.5 – National Inventory 2008

SNAP	PM2.5	
	[kt]	%
01. Combustion in production sector and energy transformation	9,6	7,33
02. Combustion in municipal and residential sectors	**58,5**	**44,77**
03. Combustion in industry	15,3	11,72
04. Production processes	9,1	6,99
07. Road transport	**19,2**	**14,70**
08. Other mobile sources and machinery	9,1	6,95
09. Waste treatment and disposal	5,6	4,28
10. Agriculture	0,55	0,42
11. Other	2,6	1,95
TOTAL	**130,7**	

Source: National Emissions Inventory 2008 [KASHUE-KOBiZE 2010]

PM2.5 in Poland 2020 [kt] – scenarios comparison



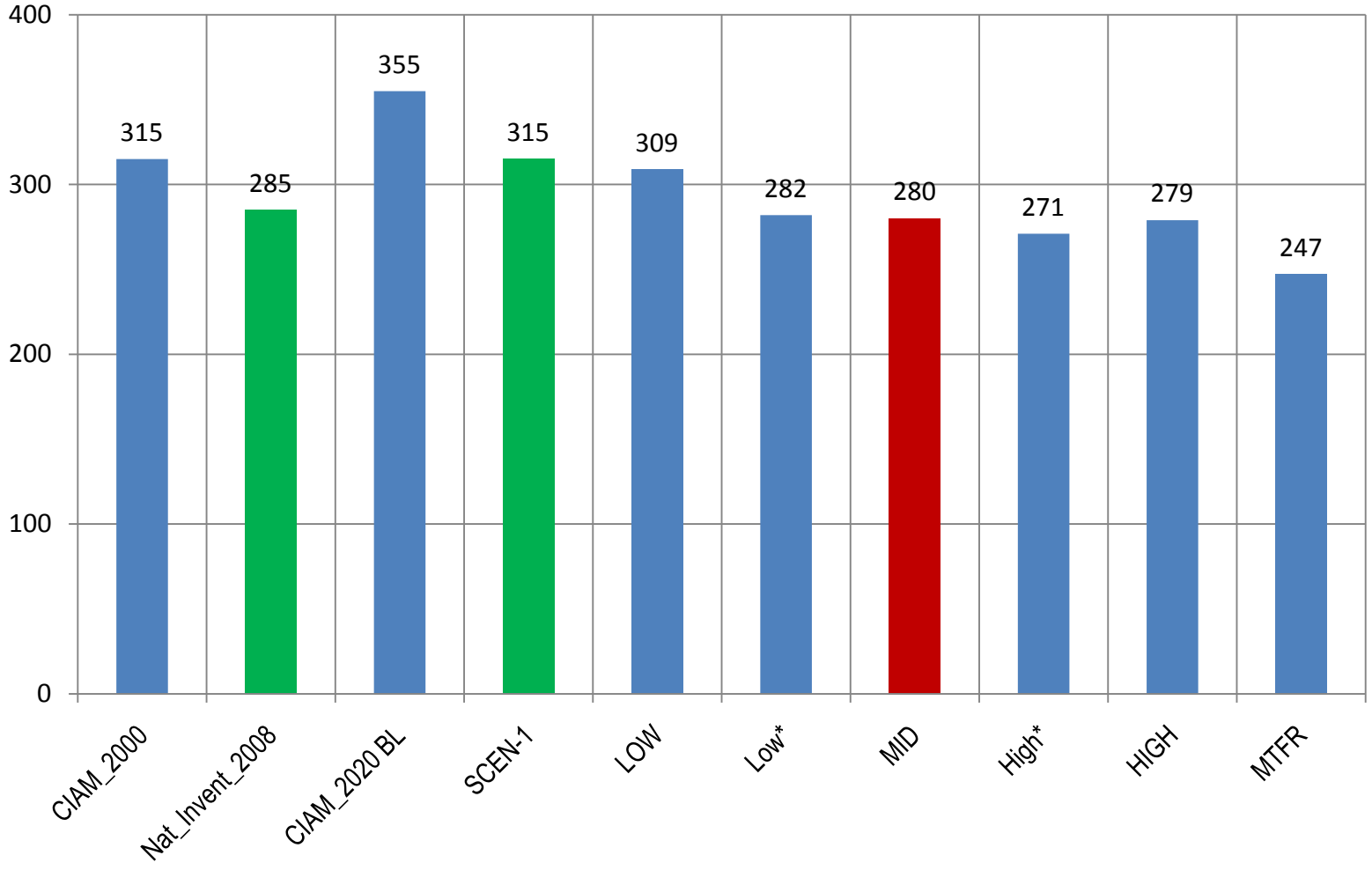
[Based on: EnergSys 2011]

NH3 – emission scenarios

Scenario based on projected activity of agriculture and animal breeding and based on inventory emission data

SNAP	National Inventory		SCEN-1
	2000	2008	2020
	kt	kt	kt
Waste management	16,0	3,2	3,2
Agriculture and forestry	218,2	195,5	**223,6**
Fertilizers use	84,4	84,0	80,7
Other	4,0	2,6	7,6
TOTAL	**322,6**	**285,3**	**315,0**

NH3 in Poland 2020 – scenarios comparison



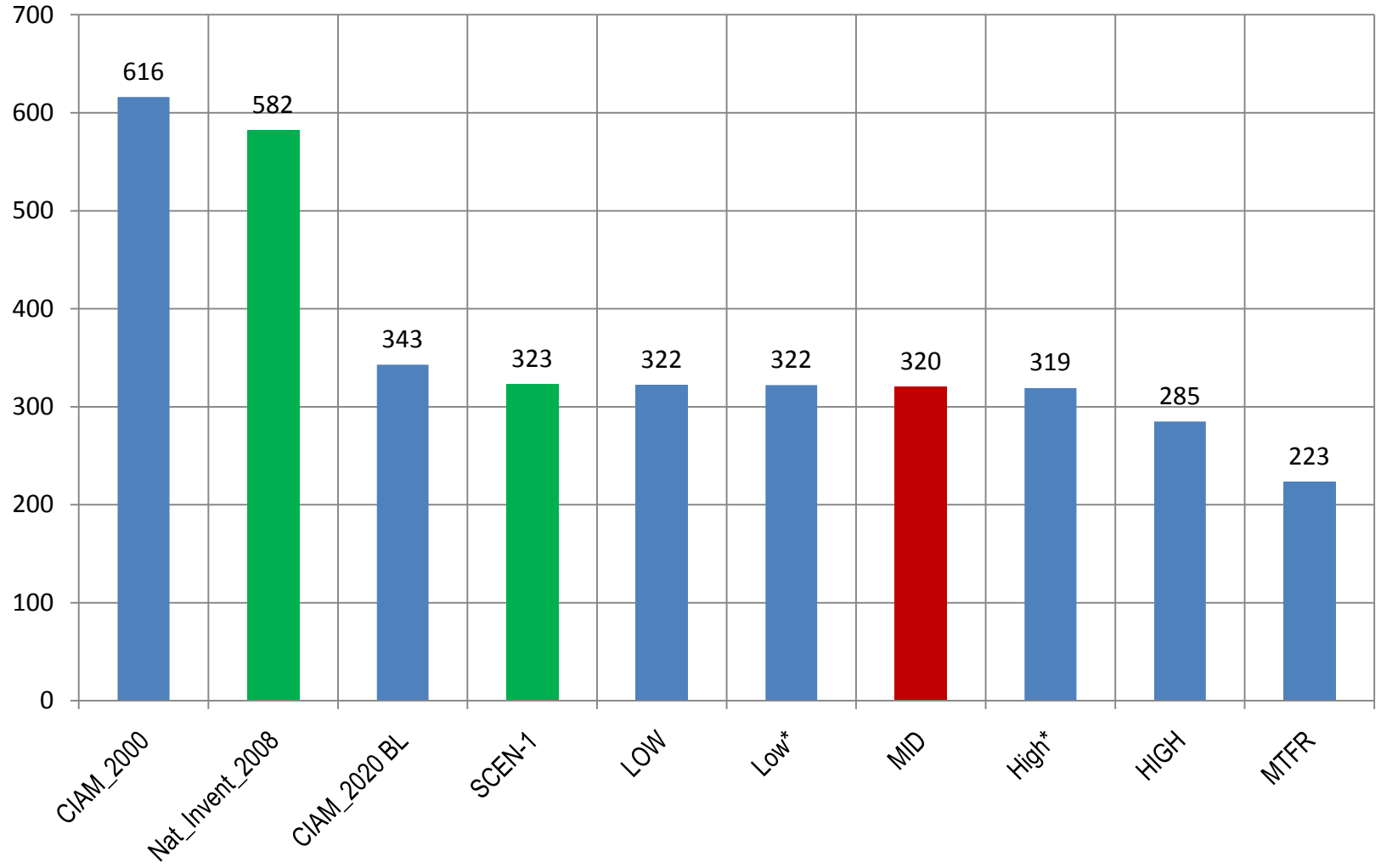
[Based on: EnergSys 2011]

VOC – Emission scenarios

Scenario is based on projected activity established in National Energy Policy 2030 and on fully implementation of Solvents and Products (paints) Directives

SNAP	National Inventory		SCEN-1
	2000	2008	2020
	kt	kt	kt
Combustion in production sector and energy transformation	12,5	16,2	17,0
Combustion in municipal and residential sectors	97,6	107,0	67,3
Combustion in industry	10,7	7,9	4,3
Production processes	73,9	67,8	58,0
Extraction and distribution of fossil fuels	33,3	39,7	39,3
Solvents and other product use	157,9	198,3	82,1
Road transport	145,6	100,0	30,8
Other mobile sources and machinery	31,0	42,7	25,2
Waste treatment and disposal	2,1	2,7	2,7
Agriculture and forestry	34,1	0,4	0,4
TOTAL	**598,7**	**582,7**	**327,1**

VOC in Poland 2020 [kt] – scenarios comparison



[Based on: EnergSys 2011]

GENERAL CONCLUSIONS

- **National scenarios need to be developed – based on projected activities for each activity sector**
- National projections for SO2, NOx, PM2.5 in 2020 are higher then IIASA baseline in 2020. Scenarios need to be verified.
- Lack of data for NH3 and VOC projections
- Emissions cuttings for Poland will be possible by switching from solid fuels to gas (SO2 and PM2.5) in particular for domestic combustion
- Road transport emissions decrease (NOx) will be possible by changing all old vehicles for new, until 2020 and/or by changing the transport structure (rail transport increase, hybrid/electric vehicles)
- Not only „end-of-pipe" techniques have to be considered to meet scenarios requirements, but techniques according to BAT, including extensive changes in industry structure and technology (i.e. exchange old combustion technology for new furnaces)

FUTURE PLANS

SOZEKO – IAM for Poland (developed by KOBiZE)

Current status:

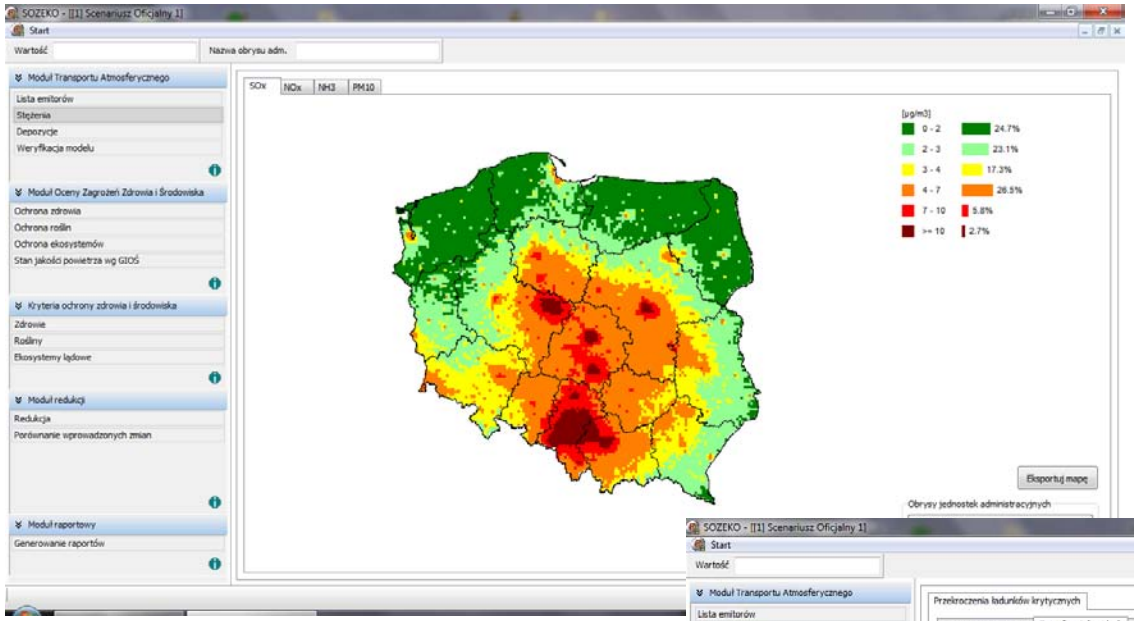
- Focused on installations (440 point sources in database)
- FRAME-PL (SO2, NOx, NH3, PM10) model 5x5 km [Kryza et al. 2009] calculations results implemented, transbonduary transport included (FRAME-Europe), source–receptor calculations done for 2005 and 2008 meteorology datasets
- CL database 1x1km implemented (250x250m for N2K)

Planned:

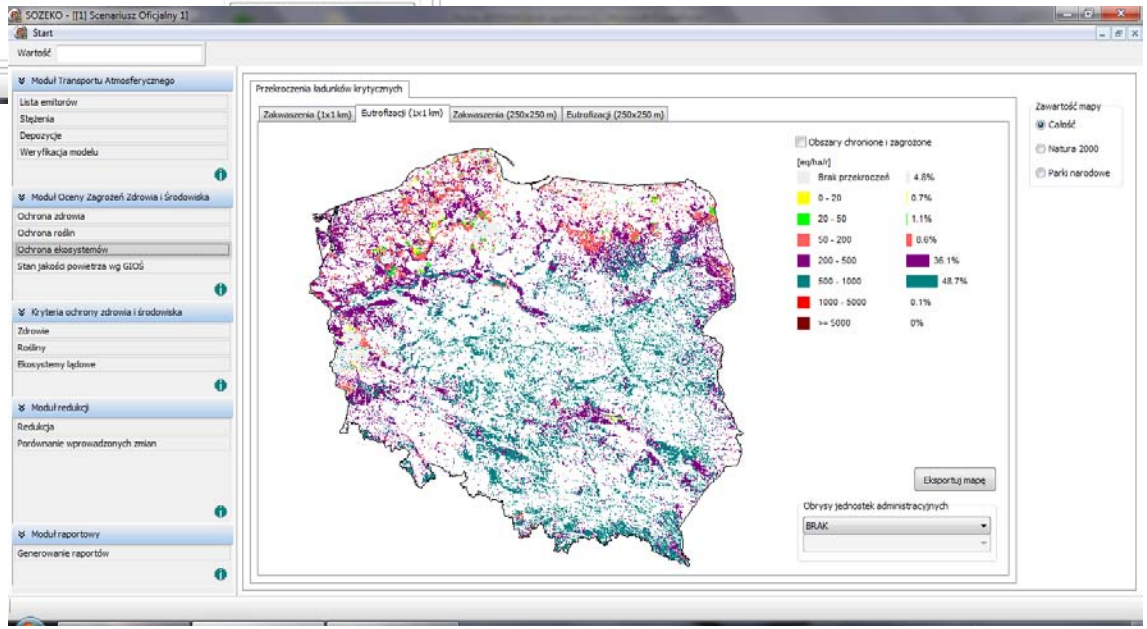
- Extending with HIA module (PM2.5, ozone in plans)
- Emission reduction module with cost-benefit calculations will be implemented
- Development of emission scenarios based on activity sectors is considered

FUTURE PLANS

SOZEKO-IAM-PL



SO2 concentrations



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NOx and NH3 dep