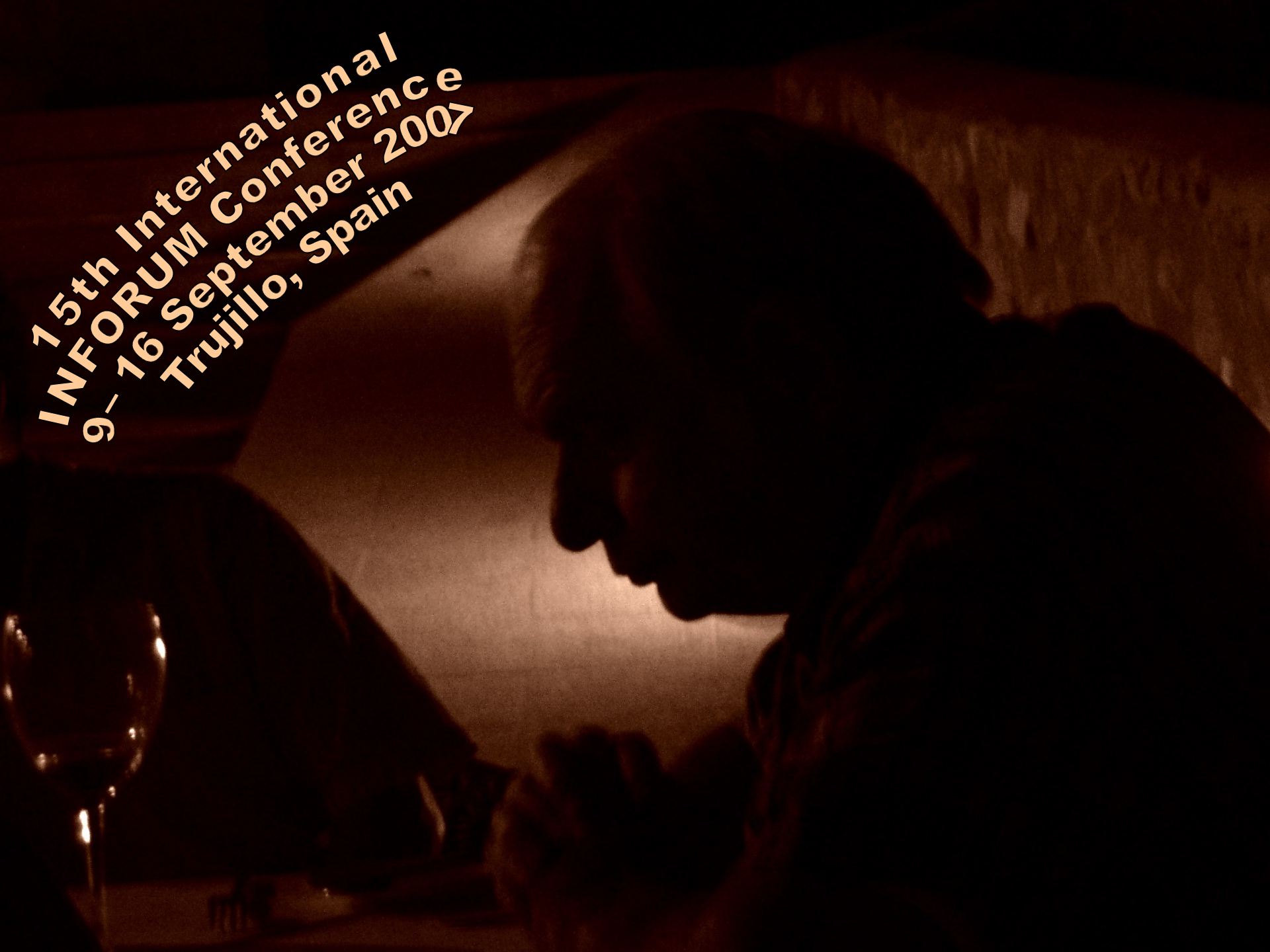
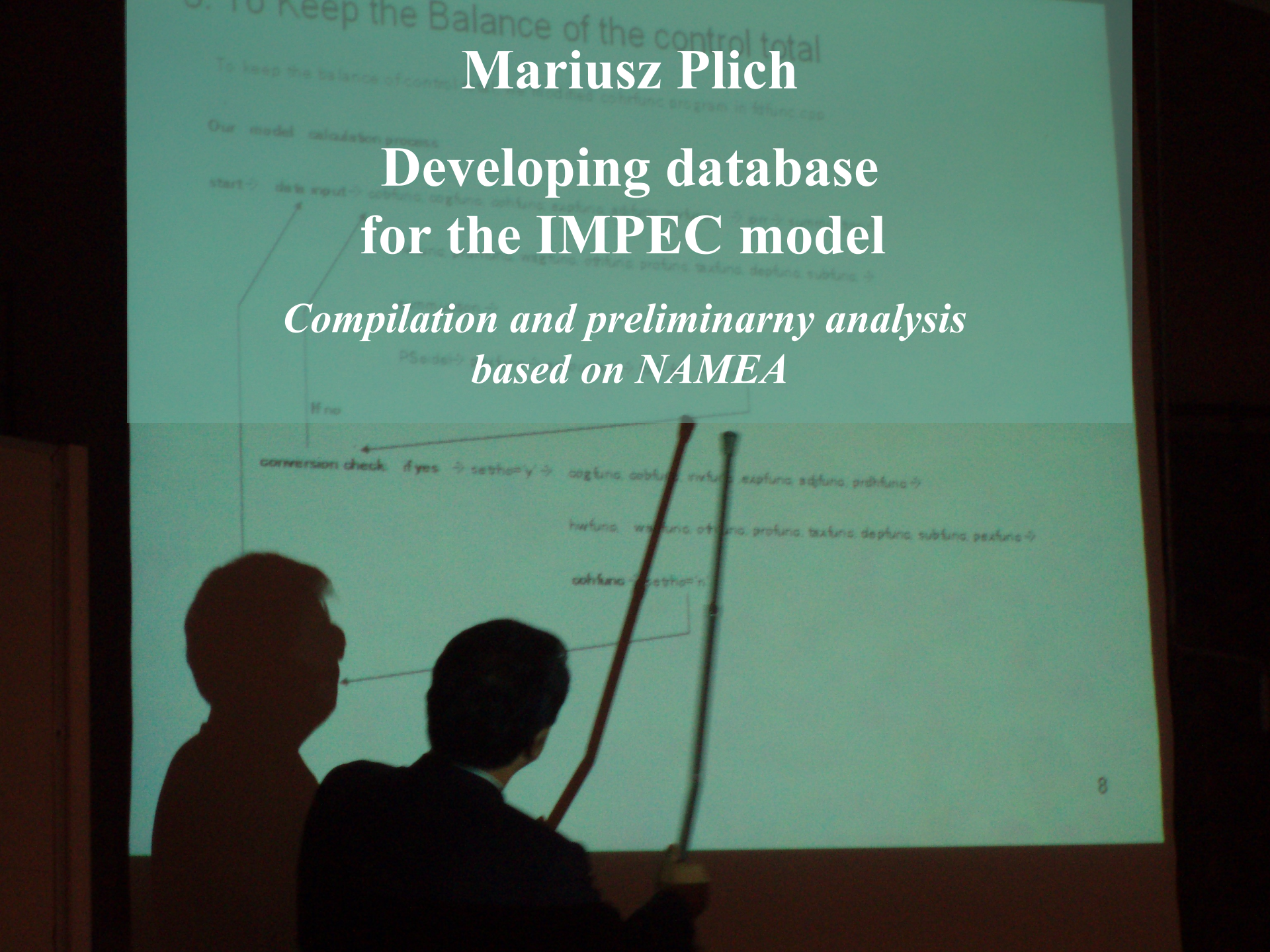

15th International
INFORUM Conference
9– 16 September 2007
Trujillo, Spain


Mariusz Plich
Developing database
for the IMPEC model
Compilation and preliminarny analysis
based on NAMEA

Plan of the presentation

1. NAMEA – what is it for?
2. Compilation of NAMEA – is it a problem?
3. Energy in NAMEA
4. Air emissions in NAMEA
5. Compilation of NAMEA.pl
6. Examples of analysis based on NAMEA.pl
7. Conclusions

NAMEA - what is it for?

National Accounting Matrix including Environmental Accounts

- Framework in which economic and environmental data are **consistently** organized
- **Hybrid structure** cause, that there are no limits on kind of environmental data being put to
- Possibility to construct **indicators** related to economy and environment

Examples of environmental themes

- climate change
- ozone layer depletion
- acidification
- eutrophication
- dispersion of toxic substances
- disposal of solid wastes
- disturbace of local environment

Compilation of NAMEA – is it a problem?

The three components of NAMEA

- **national accounts** (institutions, branches, products)
- **energy accounts** (types of fuels)
- **environmental accounts** (types of pollution, harmfulness, processes)

Problems of constructing

- methodological (common)
- organizational (country specific)

Shape of NAMEA

- original (Dutch)
- simplified (Eurostat)

Energy in NAMEA

Heating values of prime energy carriers applied to NAMEA.pl

Type of carrier	Heating value	Unit
Hard coal	22	PJ / 10^6 t
Brown coal	9	PJ / 10^6 t
Natural gas	30	PJ / km^3
Crude oil	42	PJ / 10^6 t

Source: *Energy statistics*, 2005 Central Statistical Office (GUS), Warsaw

Air emissions in NAMEA

The most advanced area of compilation of environmental part of NAMEA

Sources of air pollution

Natural

Antropogenic

- energy (**fuels combustion**, volatile fuel emission)
- industrial processes
- solvent application
- agriculture
- changes in land use and forestry
- wastes (waste sites, sewage treatment plants, waste combustion).

Air pollution surveys approaches:

- **based on air emission inventories** (processed oriented, classified according to SNAP – used in CORINAIR)
- **based on energy accounts** (supported by additional data on non-fuel related emissions, directly measured emissions or transport statistics)

Proportions of total CORINAIR emissions attributed to unique economic sector (%)

Country	CO2	CO2 bio-fuel	CH4	N2O	HFCs	PFCs	SF6	SO2	NOx	NH3	NMV OC	CO
France	53	-	99	95	100	100	100	81	43	99	62	53
Italy	74	98	92	93	-	-	-	91	50	99	50	24
Austria	83	-	99	95	-	-	-	74	86	99	98	86

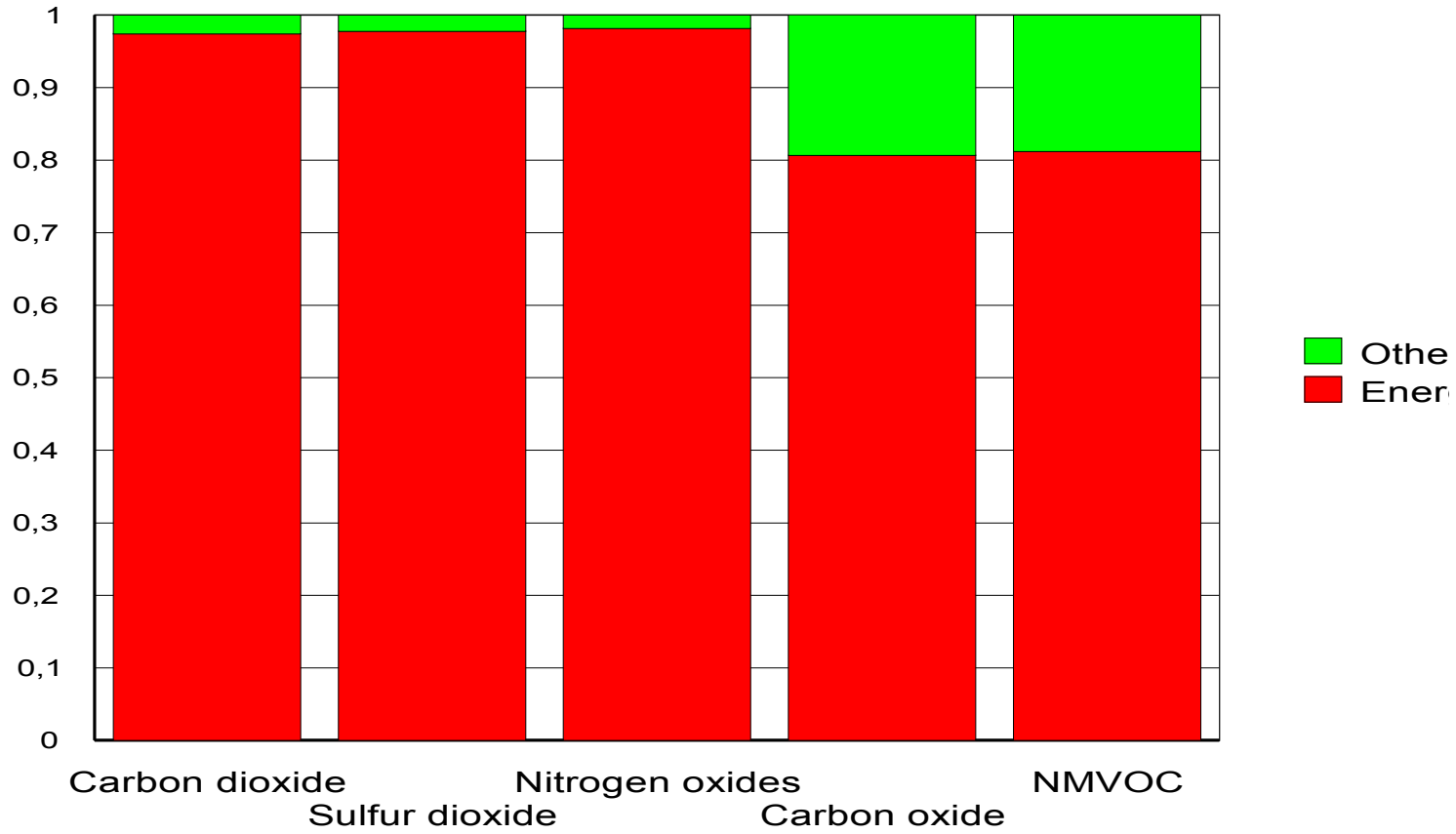
Source: Eurostat, 2003, *NAMEA for Air Emissions. Compilation Guide, p. 27*

Proportions of emissions stemming from fuel combustion (%)

Country	CO2	CH4	N2O	SO2	NOx	NH3	NMVOC	CO
Denmark	99.0	5.0	16.0	99.0	99.0	2.0	80.0	94.0
Germany	97.0	2.0	17.0	91.0	98.0	3.0	31.0	90.0
UK	95.0	3.5	14.0	98.0	99.0	-	37.0	99.0

Source: Eurostat, 2003, *NAMEA for Air Emissions. Compilation Guide, p. 21*

Structure of air emissions in Poland (%)



Compilation of NAMEA.pl

WANTED - official NAMEA for Poland (done by National Emission Center and reported to Eurostat)

Problems of compilation

- no time series of io tables
- no io tables in constant prices
- high level of aggregation

Level of details (at least)

- io table – 19 sectors plus households
- energy – 21 sources: primary (4), secondary (15), renewable (2)
- air pollutants – 7 (CO2, CO, NOx, SO2, CH4, N2O, NMVOC)

GWP and PAE weighting factors

	Greenhouse gases			Acid gases		
	CO2	N2O	CH4	SO2	NOx	NH3
GWP	1	310	21	□	□	□
PAE	□	□	□	1/32	1/46	1/17

Source: *Danish NAMEA 1980-1992.* Jensen H. V., Pedersen O. G., 1998, Statistics Denmark, Copenhagen.

Aggregation codes to convert from 57 sectors classification to NAMEA(19) and NAMEA(8)

No.	Sector	NAMEA(19)		NAMEA(8)	
		Code	Abbereviation	Code	Abbereviation
1	AgricultHunt	17	Agriculture	1	Agriculture
2	Foresrty	19	OthSectors	8	OthSectors
3	Fishing	19	OthSectors	8	OthSectors
4	CoalPeat	1	Coal	2	Mining
5	OilGas	2	OilGas	2	Mining
6	MetalOres	7	NEnMining	2	Mining
7	OtherMining	7	NEnMining	2	Mining
8	FoodBev	14	Food	5	OtherInd
9	Tabacco	14	Food	5	OtherInd
10	Textiles	13	Textile	5	OtherInd
11	WearingFurs	13	Textile	5	OtherInd
12	Leather	13	Textile	5	OtherInd
13	Wood	11	Wood	5	OtherInd
14	PulpPaper	12	Paper	5	OtherInd
15	Printed	12	Paper	5	OtherInd
16	CokeRafined	4	CokeRaf	3	RafChMin
17	Chemicals	9	Chemicals	3	RafChMin
18	RubberPlastic	15	OtherManuf	5	OtherInd
19	NonmetOth	10	Mineral	3	RafChMin
20	Metals	5	Matals	4	Metal
21	MetalProd	6	Machinery	5	OtherInd
22	MachEqOth	6	Machinery	5	OtherInd
23	OfficeComp	6	Machinery	5	OtherInd
24	ElectrMach	6	Machinery	5	OtherInd
25	RTVTeleEq	6	Machinery	5	OtherInd
26	MedlOptical	15	OtherManuf	5	OtherInd
27	Vehicles	8	TransEquip	5	OtherInd
28	TranspEqOth	8	TransEquip	5	OtherInd
29	Furniture	15	OtherManuf	5	OtherInd

No.	Sector	NAMEA(19)		NAMEA(8)	
		Code	Abbereviation	Code	Abbereviation
30	Recovered	15	OtherManuf	5	OtherInd
31	Energy	3	ElWatGas	6	Energy
32	Water	3	ElWatGas	6	Energy
33	Construction	16	BuildInd	8	OthSectors
34	VehicleTrade	19	OthSectors	8	OthSectors
35	WholesCom	19	OthSectors	8	OthSectors
36	Retail	19	OthSectors	8	OthSectors
37	HotelRestaur	19	OthSectors	8	OthSectors
38	TransportLand	18	Transport	7	Transport
39	TransportWat	18	Transport	7	Transport
40	TransportAir	18	Transport	7	Transport
41	Tourism	19	OthSectors	8	OthSectors
42	PostTelecom	19	OthSectors	8	OthSectors
43	Financial	19	OthSectors	8	OthSectors
44	InsurancePens	19	OthSectors	8	OthSectors
45	AuxFinancial	19	OthSectors	8	OthSectors
46	RealEstate	19	OthSectors	8	OthSectors
47	RentMach	19	OthSectors	8	OthSectors
48	CompServ	19	OthSectors	8	OthSectors
49	R&D	19	OthSectors	8	OthSectors
50	BusinessOther	19	OthSectors	8	OthSectors
51	Administration	19	OthSectors	8	OthSectors
52	Education	19	OthSectors	8	OthSectors
53	Health	19	OthSectors	8	OthSectors
54	Community	19	OthSectors	8	OthSectors
55	MembOrg	19	OthSectors	8	OthSectors
56	RecrCultSport	19	OthSectors	8	OthSectors
57	ServicesOth	19	OthSectors	8	OthSectors

Classification of sectors in NAMEA.pl

No.	Sectors of NAMEA(8)	
	Abbereviation	Contents (sectors of NAMEA(19))
1	Agriculture	Agriculture
2	Mining	Coal, OilGas, NEnMining
3	RafChMin	CokeRaf, Chemicals, Mineral
4	Metals	Metals
5	OthIndust	Machinery, TransEquip, Wood, Paper, Textile, Food, OtherManuf
6	Energy	ElWatGas
7	Transport	Transport
8	OthSectors	BuildInd, OthSectors

Blocks of NAMEA.pl

	Output (mln zł)								FinalUse			Imports	OthSupply	Total	Reserves				Emission (1000 tons)							EnvThemes	
	Agriculture	Mining	RafChMin	Metals	OthIndust	Energy	Transport	OthSectors	PCE	Eksports	Other				HardCoal	BrownCoa	CrudeOil	NaturalGas	CO2	SO2	NOx	CO	N2O	CH4	NMVOC	GreenhEf	Aeidific
OpenStock															**1 324 026**	**127 332**	**189**	**4 380**									
Agriculture	12 789	10	70	0	17 900	2	1	3 795	15 935	1 652	1 263	-3 433	-5 784	**44 199**					14 743	49	115	384	0,43	24,8	36	15 398	4
Mining	732	2 595	5 136	1 672	1 237	6 217	536	2 979	1 734	3 668	62	-6 386	-1 936	**18 246**					7 472	41	24	17	0,12	0,6	3	7 520	2
RafChMin	3 650	561	11 339	2 654	10 837	2 442	2 711	15 157	12 610	10 265	2 183	-13 128	-21 949	**39 332**					24 886	130	66	57	0,33	5,6	8	25 107	6
Metals	63	154	412	7 805	8 257	442	238	1 773	6	6 919	202	-2 771	-1 794	**21 705**					25 937	64	56	217	0,21	0,9	2	26 020	3
OthIndust	5 755	3 148	3 943	2 945	66 640	1 964	2 986	31 854	81 488	35 895	27 746	-36 942	-58 018	**169 404**					19 630	115	58	179	0,36	1,7	29	19 778	5
Energy	792	989	1 148	1 012	3 564	2 810	748	7 507	7 015	249	1	-21	-472	**25 341**					178 065	1 450	443	103	2,49	4,2	19	178 924	55
Transport	257	394	1 511	416	2 593	660	3 270	5 740	5 134	5 556	3	-2 508	-121	**22 903**					24 290	20	281	1 071	0,92	8,7	249	24 759	7
OthSectors	1 696	1 438	6 778	1 272	13 959	2 315	3 270	52 638	60 856	13 968	82 847	-5 746	50 259	**285 550**					8 804	34	11	247	0,16	16,2	16	9 195	1
Households																			51 710	177	40	1 597	0,92	129,1	98	54 708	6
ValueAdded	18 464	8 957	8 996	3 929	44 417	8 490	9 143	164 108																			
Total	**44 199**	**18 246**	**39 332**	**21 705**	**169 404**	**25 341**	**22 903**	**285 550**	**184 776**	**78 172**	**114 306**	**-70 935**	**-39 815**	**626 681**													
HardCoal	61	77	536	140	202	1 106	9	17	317	837		-44		**3 257**	-3 257												
BrownCoal	1	2	1	0	1	528	0	0	4					**538**		-538											
CrudeOil			560									-540		**20**			-20										
NaturalGas	0	6	114	30	15	49	0	9	160			-244		**140**				-140									
Secondary	120	51	361	289	137	129	399	113	403					**2 001**													
Renewable	19		5	0	24	1	0	11	105					**165**													
OthChanges																											
Corrections															-13	-2	8	7									
TotEnergy	200	136	1 577	459	378	1 814	408	151	988	837				**6 948**	**-3 271**	**-540**	**-12**	**-133**									
CO2																										355 538	
SO2																											65
NOx																											24
CO																											
N2O																										1 844	
CH4																										4 025	
NMVOC																											
TotalEm*																			**355 538**	**2 080**	**1 094**	*3 870*	**6**	**192**	*459*		
CloseStock															**1 320 755**	**126 793**	**177**	**4 247**									
ReservChang															3 271	540	12	133									
EnvThemes																										**361 407**	**89**

* Emissions marked by italics are not included in theme calculations.

Presentation of energy data

Sectors' shares in environmental themes and GDP

Sector	Greenhouse effect			
	shares* (%)			multi-pliers type I
	direct impact	total impact	GDP	
ElWatGas	**58.3**	**11.9**	4.0	1.3
Matals	**8.5**	**4.8**	3.5	3.1
Transport	**8.1**	**4.7**	3.7	2.3
Agriculture	5.0	4.6	7.1	3.9
Mineral	**3.6**	1.5	1.6	2.5
OthSectors	2.8	16.9	37.7	22.0
Chemicals	2.7	**4.8**	3.0	4.0
Food	2.7	**15.6**	9.3	9.8
CokeRaf	**1.9**	**4.0**	1.6	5.7
Coal	1.8	1.3	2.3	4.0
Paper	1.1	1.4	2.2	5.8
Machinery	1.0	**8.8**	6.3	21.5
Textile	0.7	**3.2**	2.5	8.7
NEnMining	0.5	0.3	0.6	5.8
Wood	0.5	0.8	1.2	7.2
TransEquip	0.4	**4.7**	2.3	20.8
BuildInd	0.2	7.5	7.9	73.6
OilGas	**0.1**	**0.0**	0.0	1.4
OtherManuf	0.0	3.0	3.2	234.0

Sector	Acidification			
	shares* (%)			multi-pliers type I
	direct impact	total impact	GDP	
ElWatGas	**66.7**	**14.0**	4.0	1.3
Transport	**8.1**	**4.9**	3.7	2.2
Agriculture	4.9	4.7	7.1	3.9
Matals	**3.9**	**3.6**	3.5	4.9
Chemicals	2.8	**5.1**	3.0	3.9
Food	2.7	**16.2**	9.3	9.5
Mineral	**2.0**	1.2	1.6	3.3
CokeRaf	**1.8**	**3.2**	1.6	4.5
Coal	1.7	1.3	2.3	4.2
OthSectors	1.3	17.2	37.7	44.4
Paper	0.9	1.4	2.2	7.1
Machinery	0.8	**8.1**	6.3	21.7
Textile	0.7	**3.4**	2.5	8.6
NEnMining	0.5	0.3	0.6	5.9
Wood	0.4	0.8	1.2	8.7
TransEquip	0.4	**4.5**	2.3	19.9
BuildInd	0.3	6.9	7.9	58.8
OilGas	**0.0**	0.0	0.0	1.8
OtherManuf	0.0	3.0	3.2	180.4

* Sectors which shares in the given theme is grater than its GDP share are indicated with bold font.

Decomposition of gorwth rate of emissions

$$Em = \frac{Em}{En} \cdot \frac{En}{Out} \cdot Out = em \cdot en \cdot Out$$

$$\frac{Em_t}{Em_0} = \frac{em_t}{em_0} \cdot \frac{en_t}{en_0} \cdot \frac{Out_t}{Out_0}$$

$$\dot{Em}_t^0 + 1 = \left(\dot{em}_t^0 + 1 \right)\left(\dot{en}_t^0 + 1 \right)\left(\dot{Out}_t^0 + 1 \right)$$

where

Em – emissions

En – energy use

Out – output

em – emission coefficient

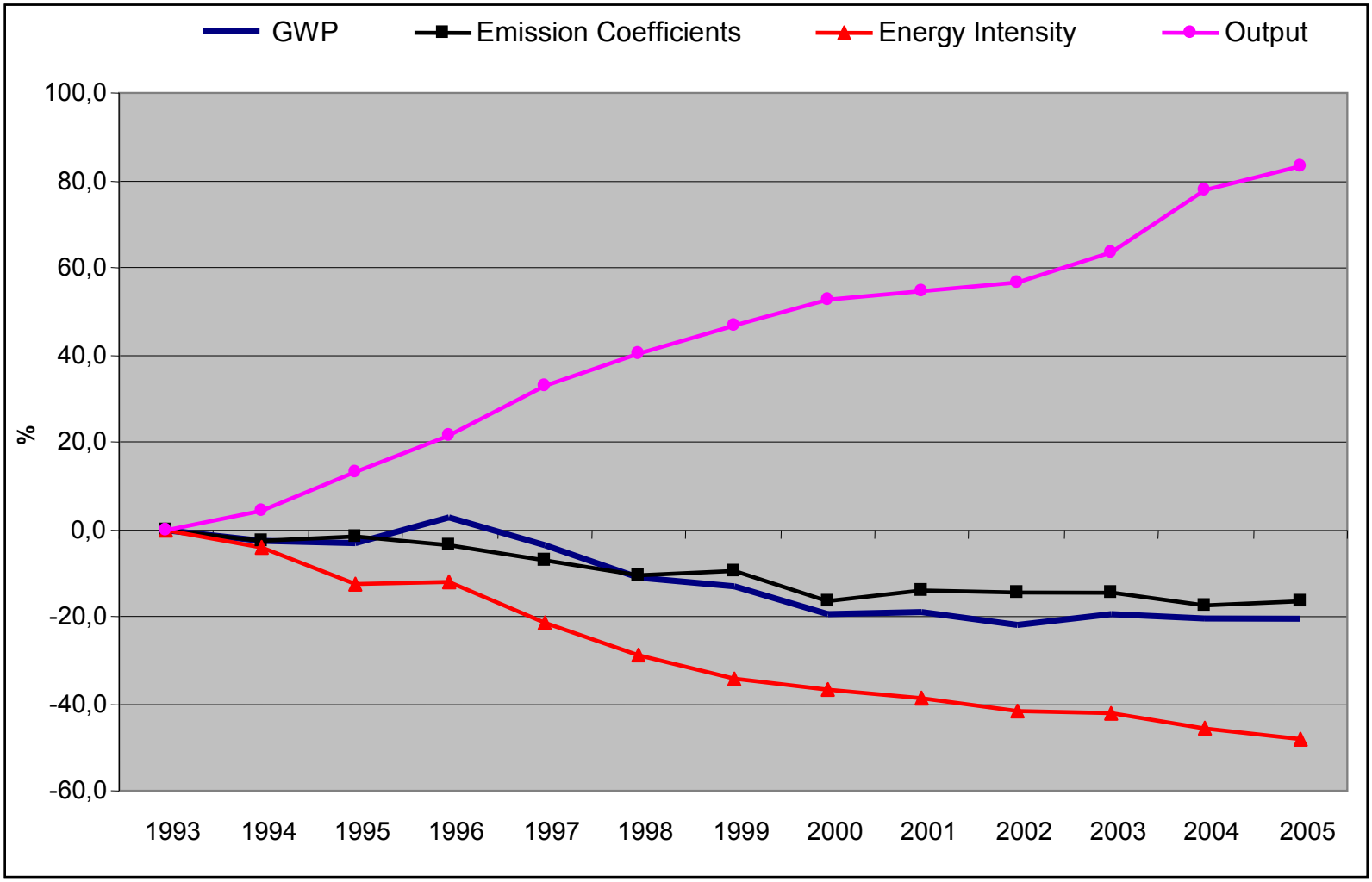
en – energy intensity

t – time

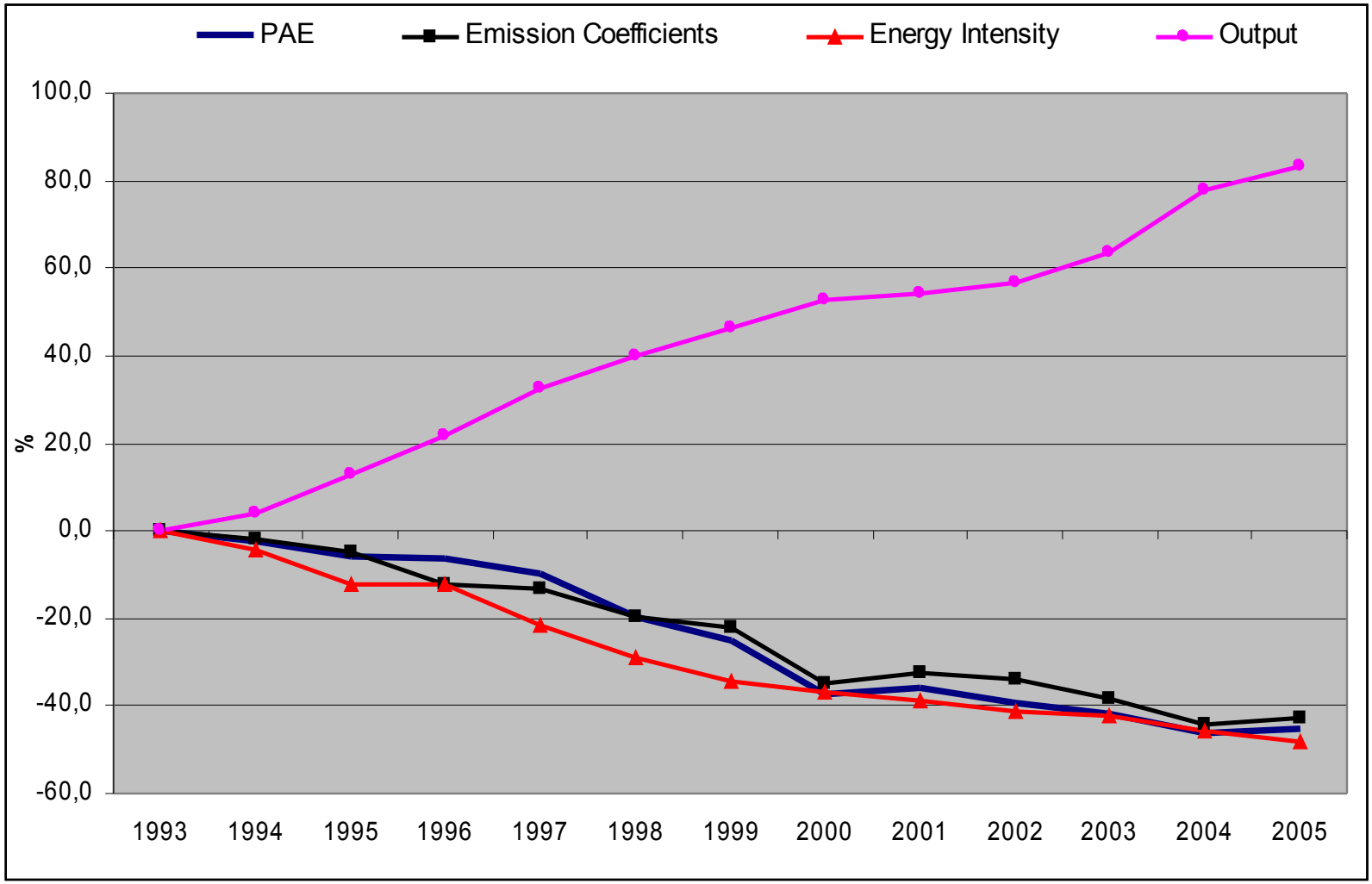
Changes in emissions, energy use and output

Specification			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Greenhouse effect	GWP	10^6 t. of CO2 equivalent	373	362	361	383	360	332	324	300	303	291	300	296	297
		growth rate compared to 1993 (%)	*0,0*	*-3,0*	*-3,0*	*2,9*	*-3,5*	*-11,0*	*-13,0*	*-19,4*	*-18,8*	*-22,0*	*-19,6*	*-20,5*	*-20,4*
	emission coefficients	10^3 t. of CO2 / PJ	60,3	58,7	59,1	58,1	56,0	53,8	54,6	50,4	51,7	51,4	51,5	49,6	50,3
		growth rate compared to 1993 (%)	*0,0*	*-2,6*	*-1,9*	*-3,6*	*-7,1*	*-10,8*	*-9,5*	*-16,3*	*-14,2*	*-14,8*	*-14,5*	*-17,7*	*-16,5*
Acidification	PAE	10^3 t. of acid equivalent	94,4	92,2	88,8	88,3	84,9	75,8	70,8	59,3	60,6	57,2	54,7	50,7	51,6
		growth rate compared to 1993 (%)	*0,0*	*-2,3*	*-5,9*	*-6,5*	*-10,0*	*-19,7*	*-25,0*	*-37,1*	*-35,8*	*-39,4*	*-42,0*	*-46,3*	*-45,4*
	emission coefficients	10^3 t. of CO2 / PJ	15,3	15,0	14,5	13,4	13,2	12,3	11,9	10,0	10,3	10,1	9,4	8,5	8,7
		growth rate compared to 1993 (%)	*0,0*	*-2,0*	*-4,8*	*-12,3*	*-13,4*	*-19,5*	*-21,9*	*-34,7*	*-32,2*	*-33,8*	*-38,4*	*-44,4*	*-42,7*
Energy intensity		PJ / 10^3 zł	*11,1*	*10,7*	*9,8*	*9,8*	*8,7*	*7,9*	*7,3*	*7,0*	*6,8*	*6,5*	*6,4*	*6,1*	*5,8*
		growth rate compared to 1993 (%)	*0,0*	*-4,4*	*-12,5*	*-12,3*	*-21,7*	*-28,8*	*-34,5*	*-36,9*	*-38,7*	*-41,5*	*-42,4*	*-45,7*	*-48,0*
Output		billion zł	555	578	627	675	736	777	814	848	857	869	907	986	1 018
		growth rate compared to 1993 (%)	*0,0*	*4,2*	*12,9*	*21,7*	*32,7*	*40,0*	*46,6*	*52,7*	*54,4*	*56,5*	*63,5*	*77,7*	*83,4*

Decomposition of GWP growth rates 1993-2005



Decomposition of PAE growth rates 1993-2005



Conclusions

- …something has been done, but…
- ….there is still a lot of to do…