



LIFE 'HAWAMAN' PROJESİ

LIFE06 TCY/TR/000292



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Industrial Hazardous Waste Inventory of Turkey

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Methods and first Results



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Conclusion (Prof. Thomanetz):

Waste balances based on regional data (per province)

-employees or sales per industrial sector

will give the best estimation for a HazWaste Investment Planning in countries without long time existing HazWasteMan-Systems. It is based on long time and multi-region experience.

Data may be improved

-with a detailed look at „the 10-20 biggest waste producers“

-in some cases with waste generation factors

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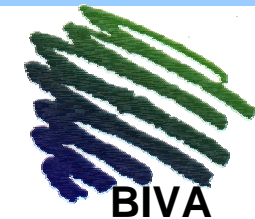
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„Cost Minimization through Environmental Protection“



Experiences:

- ▶ 13 years HIMTECH: **Industrial Waste Management** – waste balances, waste forecast data base, characterisation, logistics, storage, facilities
- ▶ 5 years state financed **Consulting Programme for Waste Minimisation in SMEs** with 2.900 on-site consultancy services, 50 guidelines, 50 workshops ...
- ▶ Organization and execution of professional training on "**management of industrial waste**" for experts from South American and African countries (3 months) and China (5 months)
- ▶ development of www.pius-info.de (information on cleaner production)
- ▶ Benchmarking of environmental data from SMEs www.buda.de



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Own Experiences on HazWasteMan

Germany: several provinces, especially preparation of waste balance of State of Hesse

Botswana, China (Zhejiang), Colombia (Region Bogota), Mexico (Central-Mexico), Taiwan, Turkey (Izmit), Tunisia



Own Experiences on Waste Inventories added by

- § waste inventories from EU-countries (EU-statistics, www.eea.eu, www.wasteandresources.dk)
- § deep knowledge / informations on several industrial sectors: e.g. BREF-documents
- § execution of waste minimisation programme in Hesse with 2.900 consultancy services

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Industrial Hazardous Waste Inventory of Turkey

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First Results



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Database – Turkish Industry:

66.000 companies with 2.440.000 empl.

- about 38.000 companies with 10 or more empl.
- about 13.000 companies with more than one TOBB-Code

Minus:

Mining (EWC01)

Logistics/Transportation*, Harbours

Construction, Contaminated soils / sites (EWC17)

Health and other public services: no sewage sludge or wastes from waste management facilities, *but power-plants* (EWC18+19)

PCBs and PCTs

Waste electrical and electronic equipment (EWC1602, 200128/135)
end-of-live-vehicles (160104)

/...



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Database – Turkish Industry:

....

- > [TOBB-Codes 3000 to 4101]
 - + separately collected fractions
 - + car repair shops*

Minus companies with less than 10 empl.

Resulting Database: **35.800 companies with 2.168.000 empl.**



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Creation of sectoral data sheets

list of specific hazardous waste types and waste amount per employee

[Agrar]	Food
Batteries (production) £	Leather
Cable £	MetalProduction £
Cement	MetalWorking £
ChemAnorgan £	Mineral
ChemFertilizer £	NonFeProduction £
ChemOrgan £	Paper
ChemOther £	Petrol/refinery £
ChemPaint £	Plastics
[CarRepairServices]	Printing
Electr.Equipment £	[SeparatelyCollectedFractions]
Energy (power plants)	Textile
	Wood

waste relevant: £ group 1 chem, £ group 2 metal, [] non industrial

Excerpt from Waste Data Sheet MetWork

1. Working step:
Input of number of
employees of this
sector and region

2. Working step:
Summation of all
data sheets

Mind: Data of Sheets
are statistical data,
and not valid for **one**
company.

Sector of Industry	Shaping and Physical and Mechanical Surface Treatment of Metals	Employees	100.000	
	abbreviation: MetWork			
Hazardous Waste				Quantity
EWK	Type of waste			[t/1000 empl.]
080111	waste paint and varnish containing organic solvents or other dangerous substances			1
080113	sludges from paint or varnish containing organic solvents or other dangerous			9
080117	wastes from paint or varnish removal containing organic solvents or other			10
xxxxxx	abc			
110105to 07	pickling acids and basis and other acids			30
110108	phosphatising sludges			10
xxxxxx	abc			
140602	other halogenated solvents and solvent mixtures			10
200121	fluorescent tubes and other mercury-containing waste			0,2
200133	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted			0,2
Total				70,4



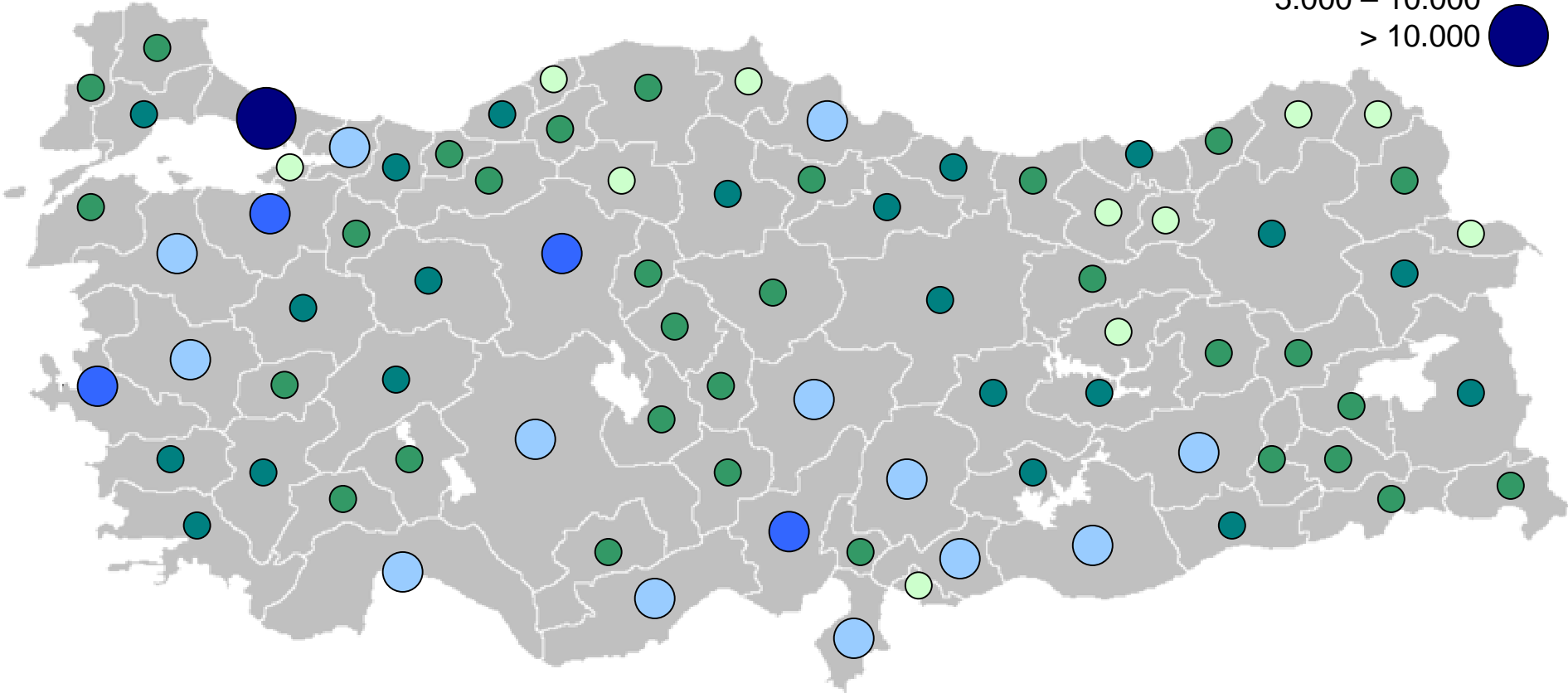
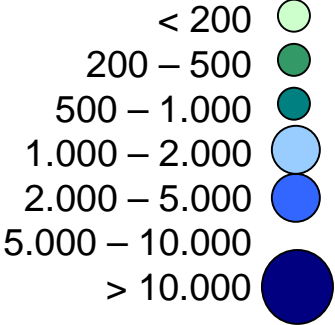
First Results:

appr. 1.350.000 t/a

from Turkish Industry

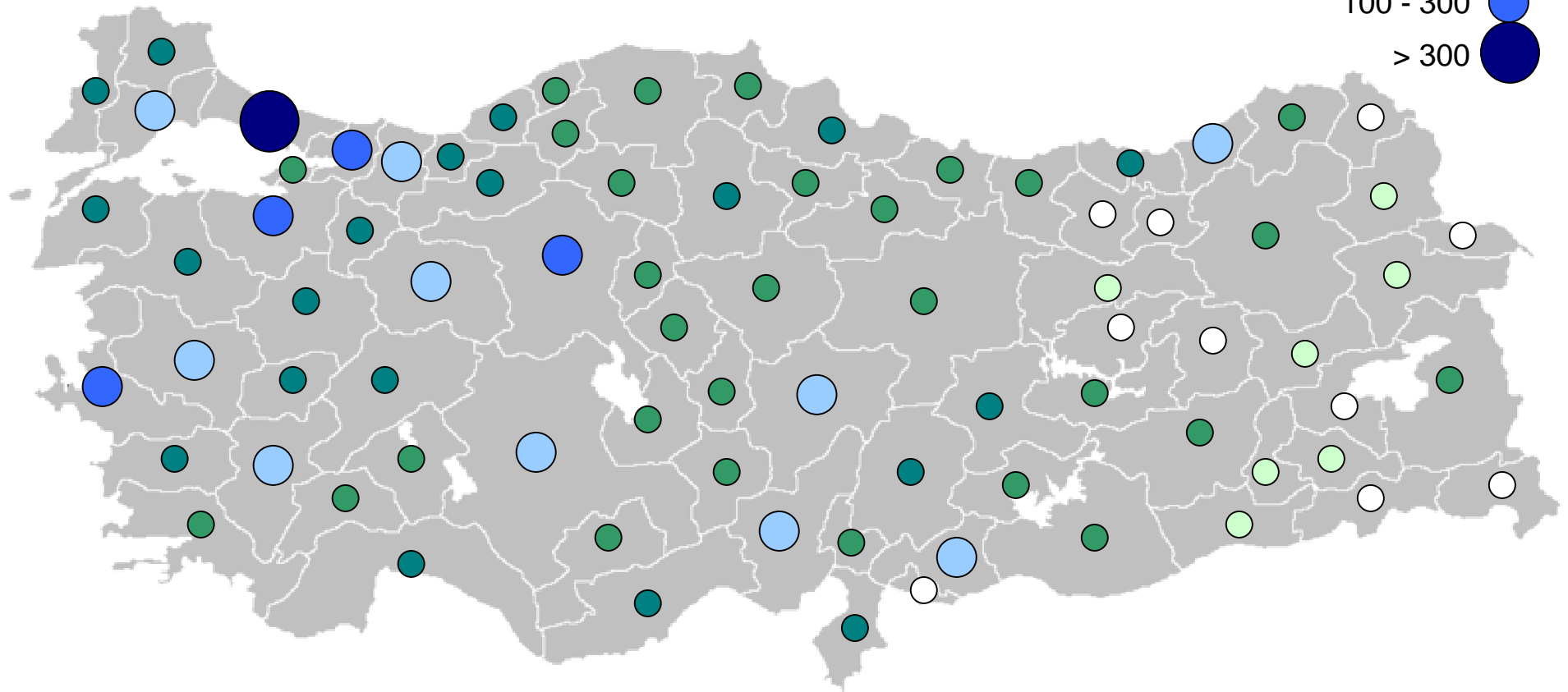
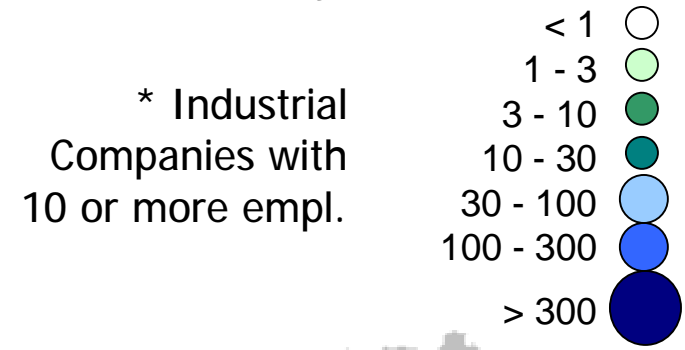
With appr. 600.000 t from **group 2 metal**
325.000 t from **group 1 chem**
250.000 t from non industr. sectors
(separately collection, car repair)

Population (1.000):



HAWAMAN Turkey
Population / Province
Author: W. Denz Date: 2008-06-14

Employees* (1.000):



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Employees / Province
of waste-relevant industries
Author: W. Denz Date: 2008-06-14

GNP (Mio. US \$):

< 300

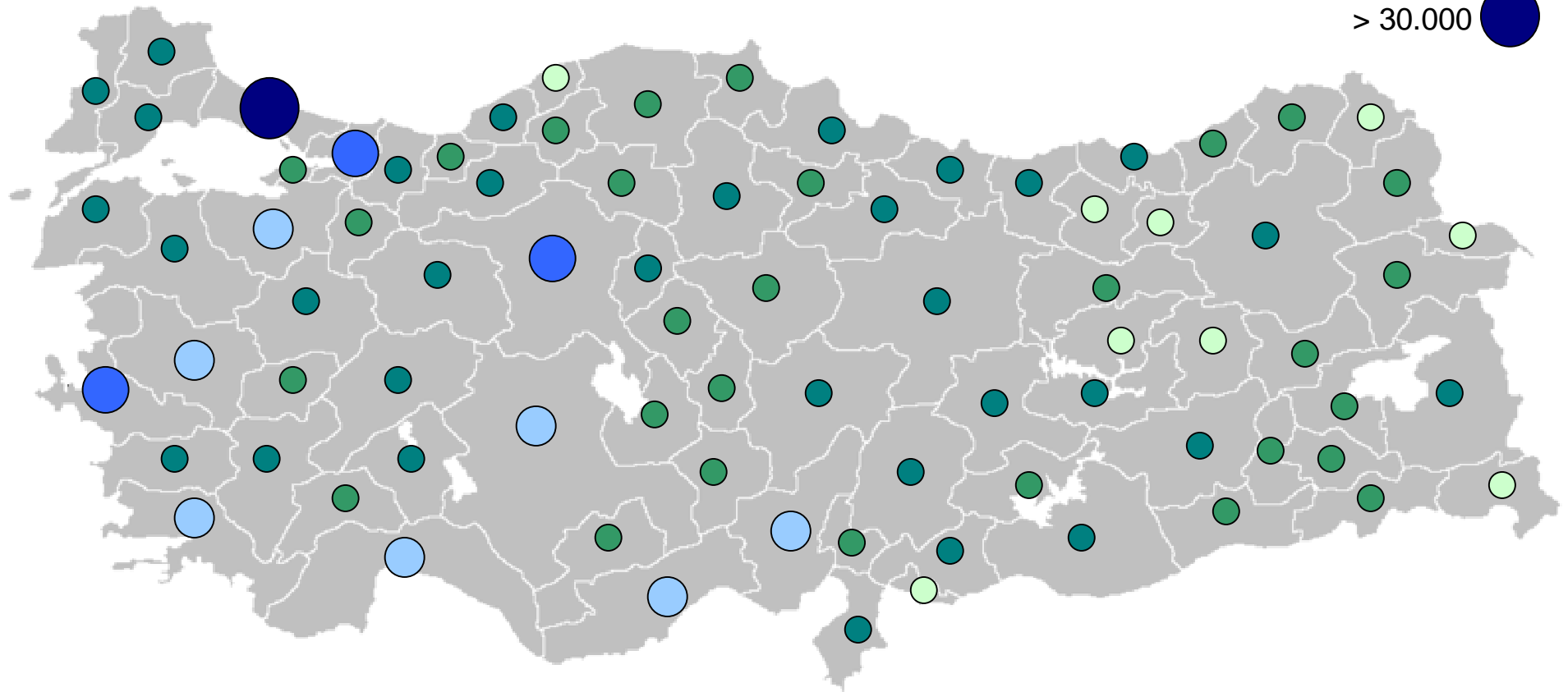
300 – 1.000

1.000 – 3.000

3.000 – 10.000

10.000 – 30.000

> 30.000

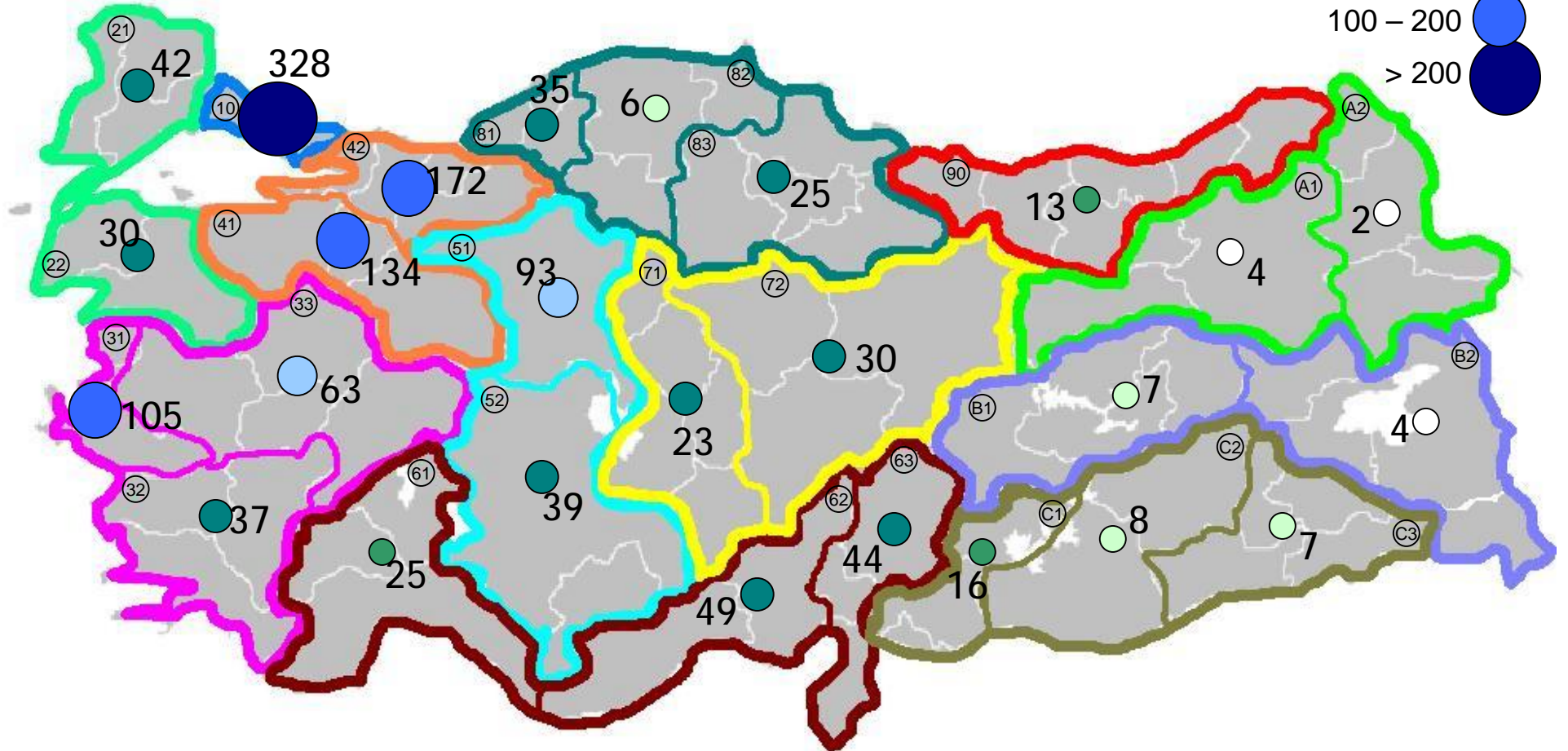
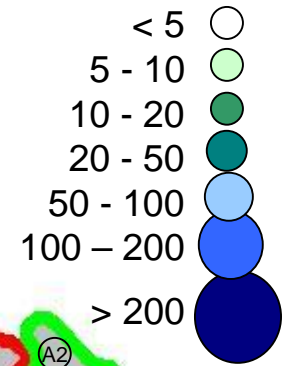


HAWAMAN Turkey

BPI / Province

Author: W. Denz Date: 2008-06-14

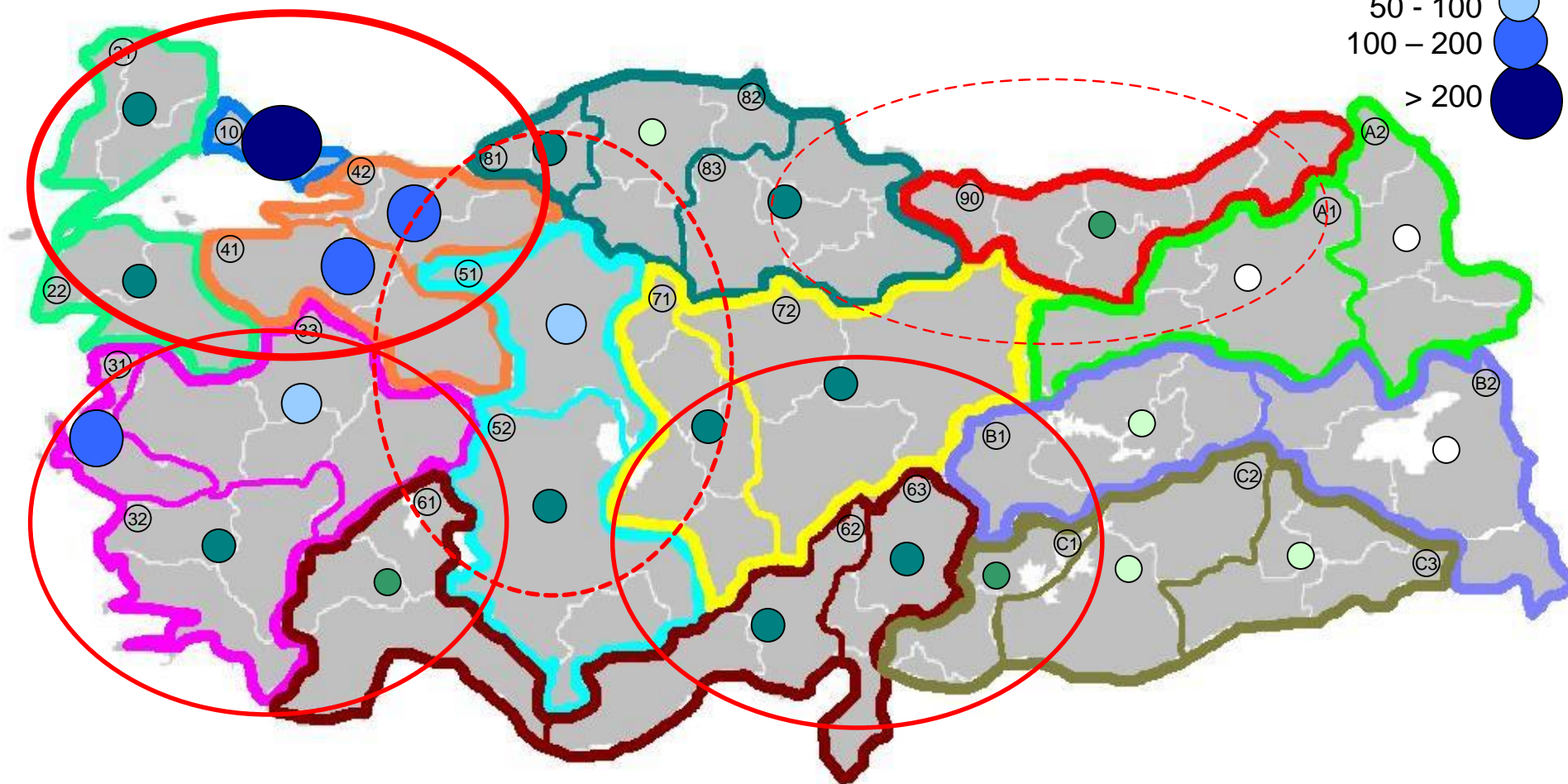
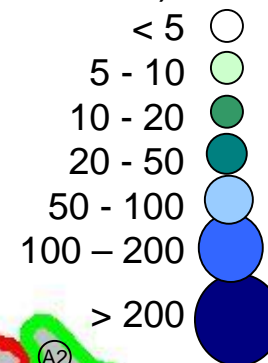
Waste (1.000 t/a):



HAWAMAN Turkey Waste / Province

First estimation (normalized)
Author: W. Denz Date: 2008-06-14

Waste (1.000 t/a):

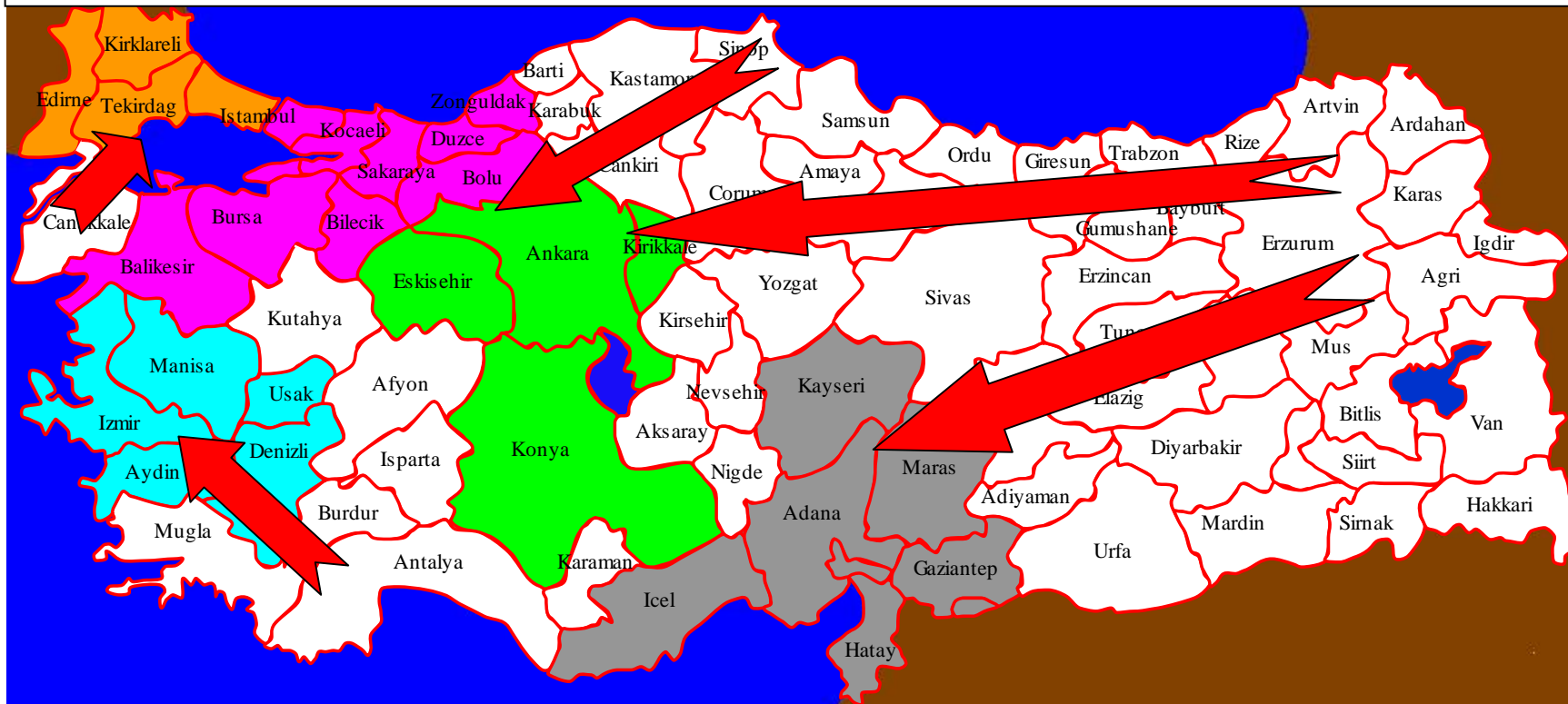


HAWAMAN Turkey Waste / Province

First estimation (normalized)
Author: W. Denz Date: 2008-06-14

First Estimation Planned Implementation (TA Heavy Cost)

Regional Systems for Hazardous Waste Management



Regional Distribution [%]

- Inhabitants
- Industr. Employees
- Hazardous Waste

Provinces	NUTS2 -Code	Capita	Industr. Empl.	Empl. Met./Ch	Haz. Waste
Istanbul	TR10	17,8	26,8	26,9	24,4
Tekirdag, Edirne, Kirklareli	TR21	2,1	5,9	2,7	3,1
Balikesir, Çanakkale	TR22	2,3	1,8	1,6	2,2
Izmir	TR31	5,3	7,1	8,6	7,9
Aydin, Denizli, Mugla	TR32	3,7	4,4	1,6	2,8
Manisa, Afyonkarahisar, Kütahya, Usak	TR33	4,2	4,4	4,7	4,6
Bursa, Eskisehir, Bilecik	TR41	4,8	10,8	12,9	10,0
Kocaeli, Sakarya, Düzce, Bolu, Yalova	TR42	4,3	8,2	14,7	12,8
Ankara	TR51	6,3	4,9	7,9	7,0
Konya, Karaman	TR52	3,1	2,6	3,0	2,9
Antalya, Isparta, Burdur	TR61	3,5	1,5	0,8	1,9
Adana, Mersin	TR62	5,1	2,9	2,9	3,6
Hatay, Kahramanmaraş, Osmaniye	TR63	4,0	2,5	2,5	3,3
Kirikkale, Aksaray, Nigde, Nevsehir, Kirsehir	TR71	2,1	1,2	1,5	1,8
Kayseri, Sivas, Yozgat	TR72	3,3	2,9	2,2	2,2
Zonguldak, Karabük, Bartin	TR81	1,4	1,3	2,1	2,6
Kastamonu, Çankiri, Sinop	TR82	1,0	0,7	0,3	0,4
Samsun, Tokat, Çorum, Amasya	TR83	3,9	2,0	1,2	1,9
Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	TR90	3,5	2,6	0,5	1,0
Erzurum, Erzincan, Bayburt	TRA1	1,5	0,3	0,1	0,3
Agri, Kars, Iğdir, Ardahan	TRA2	1,6	0,2	0,0	0,2
Malatya, Elazığ, Bingöl, Tunceli	TRB1	2,3	0,9	0,3	0,5
Van, Mus, Bitlis, Hakkari	TRB2	2,8	0,3	0,1	0,3
Gaziantep, Adiyaman, Kilis	TRC1	3,2	2,9	0,5	1,2
Sanliurfa, Diyarbakir	TRC2	4,2	0,6	0,2	0,6
Mardin, Batman, Siirt, Şanlıurfa	TRC3	2,7	0,3	0,2	0,5
Turkey Total		100,0	100,0	100,0	100,0



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For comparison / validation:

Haz. Waste Situation in Germany 2006

150 Mio. t waste, with **18.7 Mio. t haz. wastes**

3.9 Mio. t treated in company

14.7 Mio. t in treatment plants

Minus: EWC 01 Mining

EWC 17 Construction / Demolition (6 Mio. t)

EWC 18 Health Care

EWC 19 Waste + Waste Water Treatment (3.5 Mio. t)

EWC 160104 End-of-live-vehicles

EWC 200123/135 Electr. Equipment

5.3 Mio. t Haz. Waste from Industry + car repair + sep. collect
disposed or recovered in treatment plants



Comparing Haz. Waste Situation Germany - Turkey:

	Germany	Turkey	haz. waste calc. (Mio.t)
Capita (Mio.)	82	74	4,7
GNP (Bill. US\$)	3.200	593	1,0
- of Industry	960	142	0,8
GNP „power parity“	2.780	870	1,7
- of Industry	840	218	1,3
Empl. Industry (Mio.) (> 10 Empl.)	~ 9	2,17	1,3
Main Industry	MetalWorks Chemistry	(Textile) (Food) MetalWorks	



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Discussion:

Our result based on the data sheets coincides well with the values that are based on GNP or industrial employees for Turkey

Take into account that

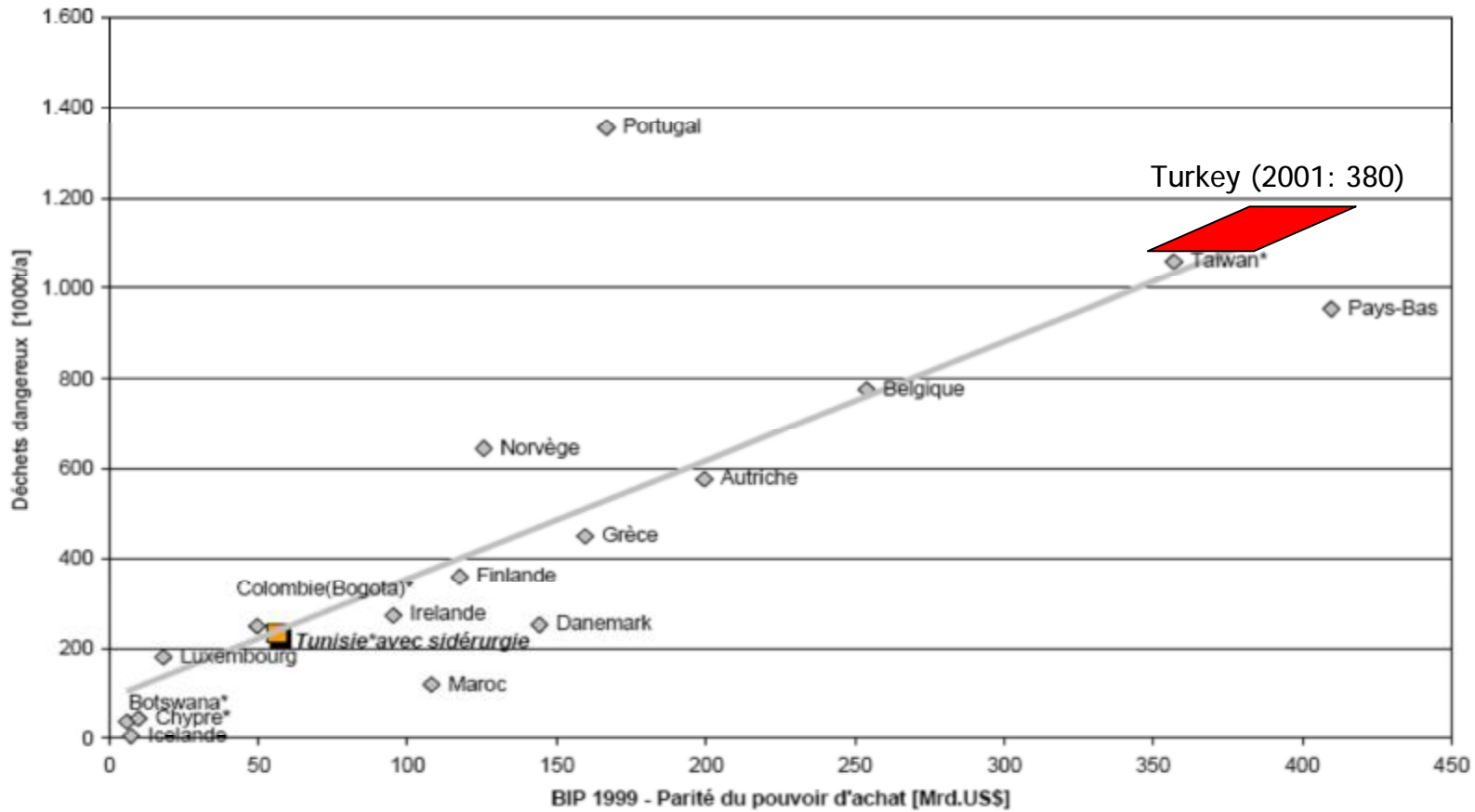
- in Germany the key sectors are the waste relevant sectors metals and chemicals, in Turkey besides metalworking industries the non waste relevant sectors textile / leather and food.
- in Turkey productivity per employee is significantly lower than in Germany.
- in Germany the "dirty", waste relevant production declines, assembling prefabricated parts produced abroad increases.

Pos. 1+2 have a reducing, Pos. 3 an increasing effect on the waste amounts of Turkey.

HazWasteAmount* in different countries

* all kinds of haz. waste

Turkey (2007: 870)
-> 2.2 Mio. t



GNP Power Parity [Bill. US\$]

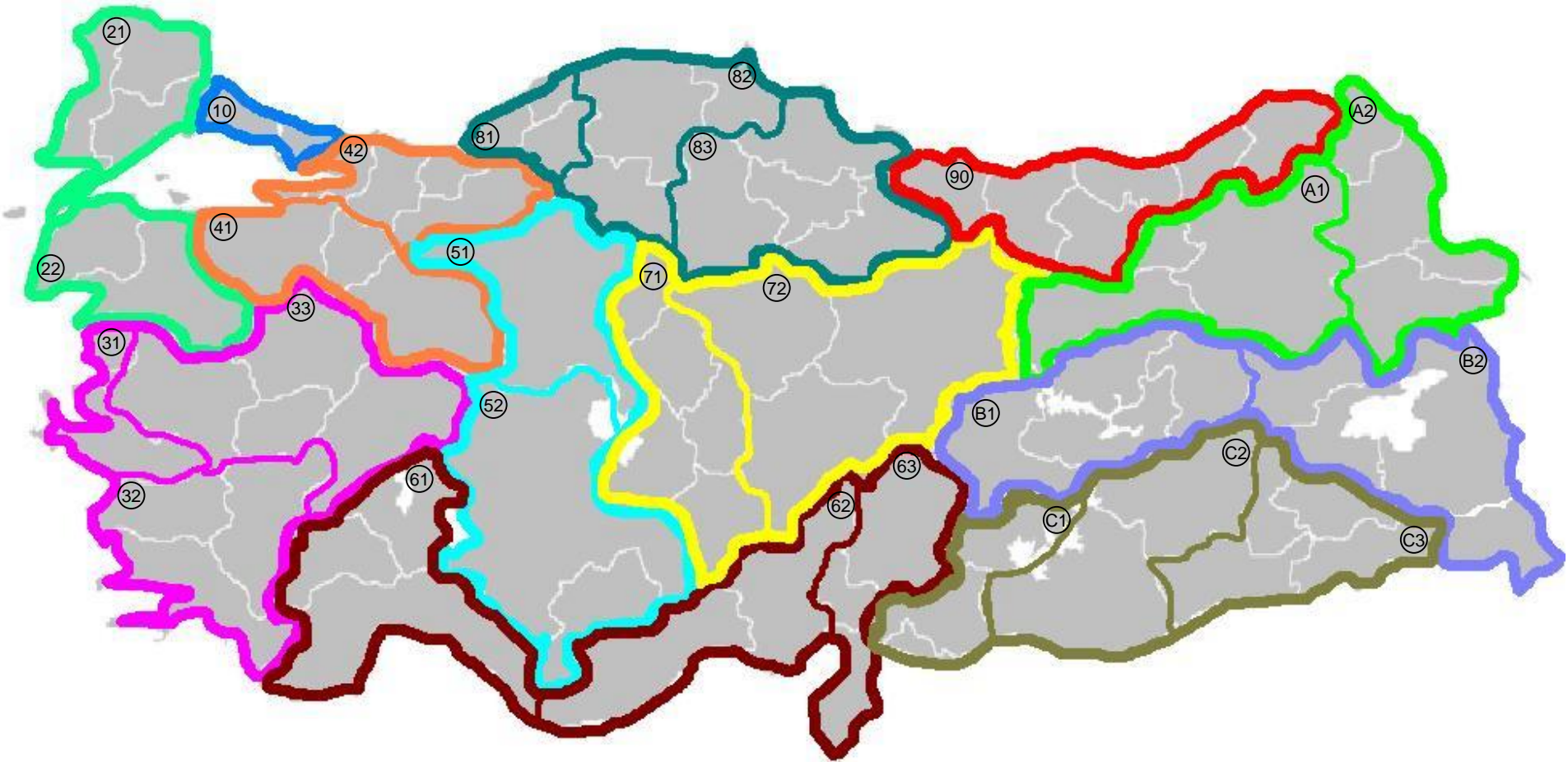
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Provinces with NUTS2 codes

Author: W. Denz Date: 2008-06-14



Next Step (KfW-project):

Sector of Industry	Shaping and Physical and Mechanical Surface Treatment of Metals			Employees	100.000										Adjustment factor:	1	
	abbreviation: MetWork																
Hazardous Waste		Consistency [%]				Treatment [%]						Type of storage / transport [%]				Quantity	
EWC	Type of waste	solid	pasty	liquid	other	dumping without pretreatment	dumping with pretreatment	physico-chemical treatment	incineration	materials recovery	thermal recovery	dump truck	container 0,4-1,5 m³	barrel < 200 l	tank truck	other	[t/1000 empl.]
080111	waste paint and varnish containing organic	70	20	10					100								1



Provinces	NUTS2 -Code	Capita	Industr. Employees	Empl. Met./Chem	Hazardous Waste [t/a]
Istanbul	TR10	12.573.836	579.346	196.027	327.200
Tekirdag, Edirne, Kırklareli	TR21	1.458.114	128.223	19.906	42.100
Balıkesir, Çanakkale	TR22	1.594.441	39.162	11.483	29.700
Izmir	TR31	3.739.353	154.339	62.323	105.300
Aydin, Denizli, Mugla	TR32	2.620.452	95.211	11.847	37.000
Manisa, Afyonkarahisar, Kütahya, Usak	TR33	2.939.517	95.681	34.286	61.800
Bursa, Eskisehir, Bilecik	TR41	3.368.502	232.529	93.658	133.900
Kocaeli, Sakarya, Düzce, Bolu, Yalova	TR42	3.048.651	176.901	106.908	171.200
Ankara	TR51	4.466.756	106.128	57.399	93.300
Konya, Karaman	TR52	2.185.131	56.929	21.966	38.500
Antalya, Isparta, Burdur	TR61	2.460.321	31.746	6.176	25.400
Adana, Mersin	TR62	3.602.588	61.877	21.284	48.900
Hatay, Kahramanmaraş, Osmaniye	TR63	2.843.518	53.380	18.153	44.400
Kirikkale, Aksaray, Niğde, Nevşehir, Kırşehir	TR71	1.481.248	25.163	10.883	23.600
Kayseri, Sivas, Yozgat	TR72	2.295.679	63.303	16.262	30.000
Zonguldak, Karabük, Bartın	TR81	1.016.484	28.925	15.537	35.200
Kastamonu, Çankiri, Sinop	TR82	732.790	15.324	2.363	5.800
Samsun, Tokat, Çorum, Amasya	TR83	2.728.183	42.847	8.696	25.300
Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	TR90	2.488.652	57.030	3.423	12.800
Erzurum, Erzincan, Bayburt	TRA1	1.075.088	6.744	860	4.400
Agri, Kars, Iğdir, Ardahan	TRA2	1.137.671	4.364	164	2.300
Malatya, Elazığ, Bingöl, Tunceli	TRB1	1.598.897	19.001	2.015	7.000
Van, Mus, Bitlis, Hakkari	TRB2	1.959.535	6.332	417	4.100
Gaziantep, Adıyaman, Kilis	TRC1	2.261.242	62.001	3.397	16.200
Sanlıurfa, Diyarbakir	TRC2	2.983.813	12.975	1.370	8.300
Mardin, Batman, Siirt, Şanlıurfa	TRC3	1.925.794	6.176	1.115	6.800
Turkey Total		70.586.256	2.161.634	727.918	1.340.500



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Industrial Waste Inventories

—

Methods and Problems

in regions without (long time)
existing HazWasteManSystem

1. Data from waste generators
2. Data from waste transportation
3. Data from waste treatment facilities



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1. Data from waste generators

1a. Asking waste generators:

no reliable data, because wastes and waste amounts often are unknown (stored vs. produced wastes), participation \ll 100 %, labor and time intensive

1b. Material balances:

rarely existing, very labor and time intensive

1c. Internal Notification:

see above, sometimes consciously bigger or smaller amounts are predicted

Even with long time existing HazWasteManSystems Internal Notification will not give reliable data



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2.+3. Data from waste transportation and treatment

Because a HazWasteManSystem is not existing or not covering the hole country / all kinds of waste, few and incomplete data are existing.

But even with a long time existing HazWasteManSystem these data give gaps between the waste-amounts from

- waste generators to waste transportation service
- waste transportation service to waste facilities

(e.g. m³-to-tonne conversion,
partly filled transportation units,
evaporation of water during transportation / storage...)



Industrial Waste Inventories

—

Methods and Problems

in regions without (long time)
existing HazWasteManSystem

4. Data based on material and product amounts
5. Data based on inhabitants/employees and GNP/sales



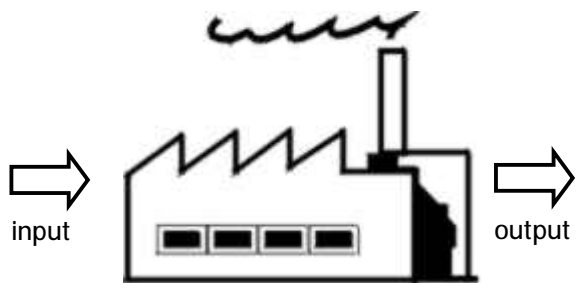
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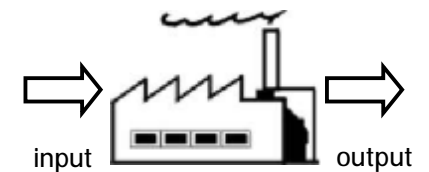
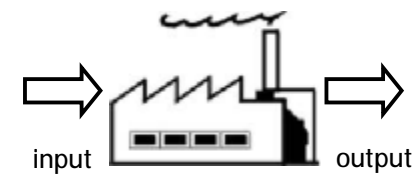
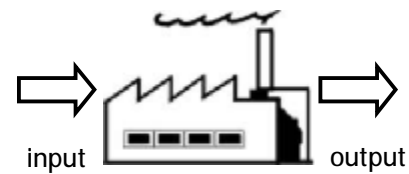
4. Data based on material and product amounts

- material input and product output data and the associated waste ratios are not available for all industrial sectors and only from few countries
- even if these data are known:
 - the material efficiency = waste ratios can differ by magnitudes from company to company
 - statistical problems can falsify the data:
 - a. waste per produced vehicle: truck or compact car?
 - b. vertical range of manufacture: complete production at facility or assembling of parts?
 - c. see figure next page
 - > The more you go in detail the more questions arise
- > useful for some industrial sectors

c1. Production in 1 facility



c2. Production in 3 facilities



Material/Product: 100 %
Employees/Sales: 100 %

300 %
100 %



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5. Data based on inhabitants/employees and GNP/sales

5a. Data based on inhabitants/employees/GNP (per region):

- a lot of data are available, but only from countries with long time existing HazWasteMan Systems,
- the specific industrial structure is ignored,
- gives a **first rough estimation** about waste situation (per region)

5b. Data based on employees/sales per industrial sector (per region):

- data are available, dito
- gives a **good estimation** about waste situation (per region)
- improvable by knowledge of situation in similar countries



Problems / Discussion:

Comparing waste factors from other countries mind:

- big waste factors are mainly caused by mineral wastes (e.g. Luxemburg > 50% contaminated soils!)
- sometimes HazWaste, which is recycled, is in/excluded
- sometimes HazWaste, which is treated by the waste generator, is in/excluded
- some regional waste balances are worked out by consultants, who are interested in big waste amounts
- waste factors for countries with no (long time) existing HazWasteManSystem are copied one by one and are based on method 5a.



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Problems / Discussion – Future Waste Amounts:

future waste amounts depend on

- the presence of waste facilities
- the possibility of waste recycling
- the costs for waste treatment
- the authorities (control, penalties)
- limits for gas emissions (filter dust and sludges from flue gas cleaning) and sewage (waste water sludges)
- the change in industrial structure:
e.g. less textile, more metal industry
- economic growth
- mind the „Delinking“ between GNP and waste amounts
- waste minimisation / material efficiency