



Research results 2013/2014

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Overview

- Research results 2013/2014
 - European Waste-to-Energy facilities
 - Review of HRE WTE data assembly
 - Establishing compatibility to E-PRTR & ISWA 2012
 - HRE WTE List v5
 - Heat Roadmap Europe – Mapping paper
 - Brief background
 - Regional heat balances
 - Strategic heat synergy regions
 - Input to 3rd 4DH Conference
 - In-depth account for HRE – Mapping paper

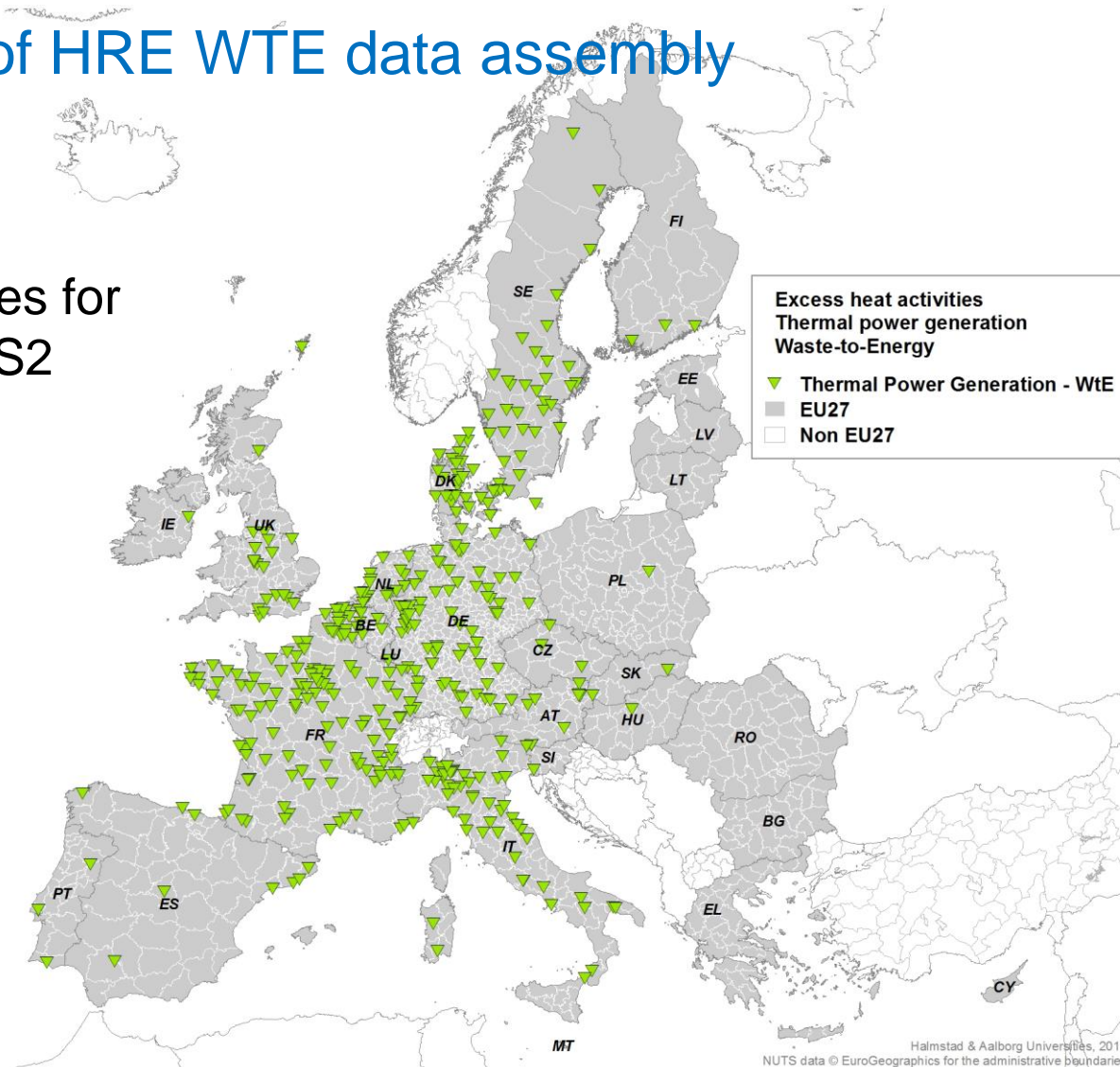
European Waste-to-Energy facilities

- Review of HRE WTE data assembly
 - **First version (v1) in spring of 2012**
 - 410 facilities for HRE PS1
 - 286 (70%) with FacilityID & geo. coordinates from E-PRTR v3.3
 - 351 (86%) with cap. data (data year mainly 2006 to 2009)
 - **Second version (v2) in spring of 2013**
 - 410 facilities for HRE PS2
 - 286 (70%) with FacilityID & geo. coordinates from E-PRTR v3.3
 - 378 (92%) with cap. data (data year mainly 2006 to 2009)

European Waste-to-Energy facilities

- Review of HRE WTE data assembly

410 facilities for
HRE PS2



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 - **Review in autumn 2013**
 - v3: E-PRTR v4.2: Main activity sectors & Directive 2000/76/EC

European Waste-to-Energy facilities

- Review of HRE WTE data assembly

- The European Pollutant Release and Transfer Register (E-PRTR, v4.2)

Main sectors	Count of FacilityID					
	2001	2004	2007	2008	2009	2010
1. Energy sector			1884	1978	2015	2047
2. Productiona and processing of metals			4004	4250	4336	4397
3. Mineral Industry			2168	2280	2216	2140
4. Chemical industry			2620	2772	2828	2834
5. Waste and waste water management			6338	7361	7711	8481
6. Paper and wood production processing			835	875	853	836
7. Intensive livestock production and aquaculture			5686	5937	6136	6163
8. Animal and veg. products ... food and beverage sector			1771	1946	2009	2047
9. Other activities			1130	1230	1278	1345

European Waste-to-Energy facilities

- Review of HRE WTE data assembly

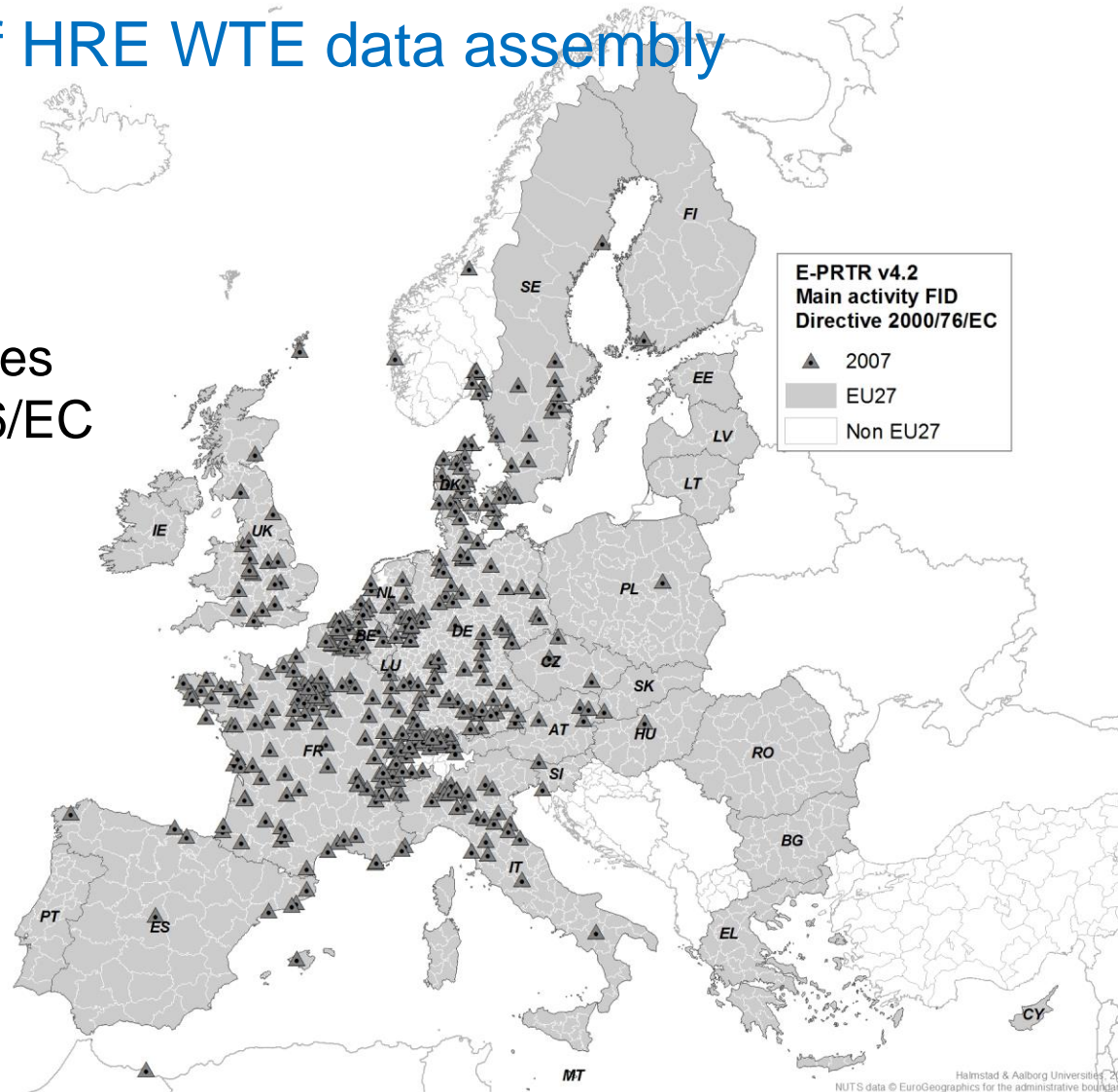
- The European Pollutant Release and Transfer Register (E-PRTR, v4.2)
- **Activity sector 5.(b):** “Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste”

Main activity sectors	Count of FacilityID					
	2001	2004	2007	2008	2009	2010
E-PRTR 5. Waste and waste water management			6338	7361	7711	8481
5. (a) ... recovery or disposal of hazardous waste			1822	1961	2206	2175
5. (b) ... incineration of non-hazardous waste... Directive 2000/76/EC			378	391	411	422
5. (c) ... disposal of non-hazardous waste			1580	2279	2294	3047
5. (d) Landfills (see note in Guidance Document)			1398	1476	1492	1506
5. (e) ... disposal or recycling of animal carcasses and animal waste			126	138	154	156
5. (f) Urban waste water treatment plants			972	1051	1094	1115

European Waste-to-Energy facilities

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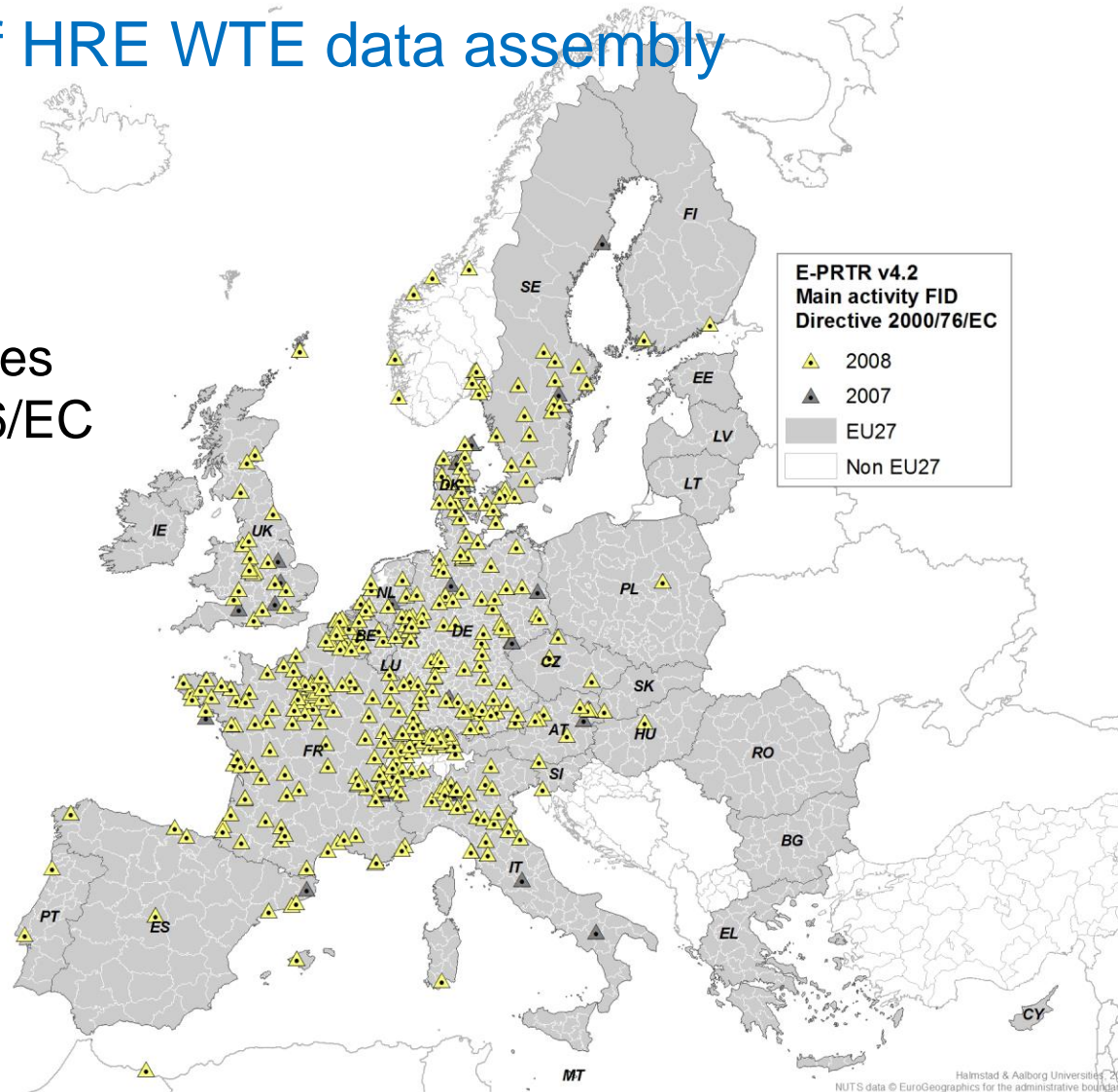
2007
378 facilities
Dir. 2000/76/EC



European Waste-to-Energy facilities

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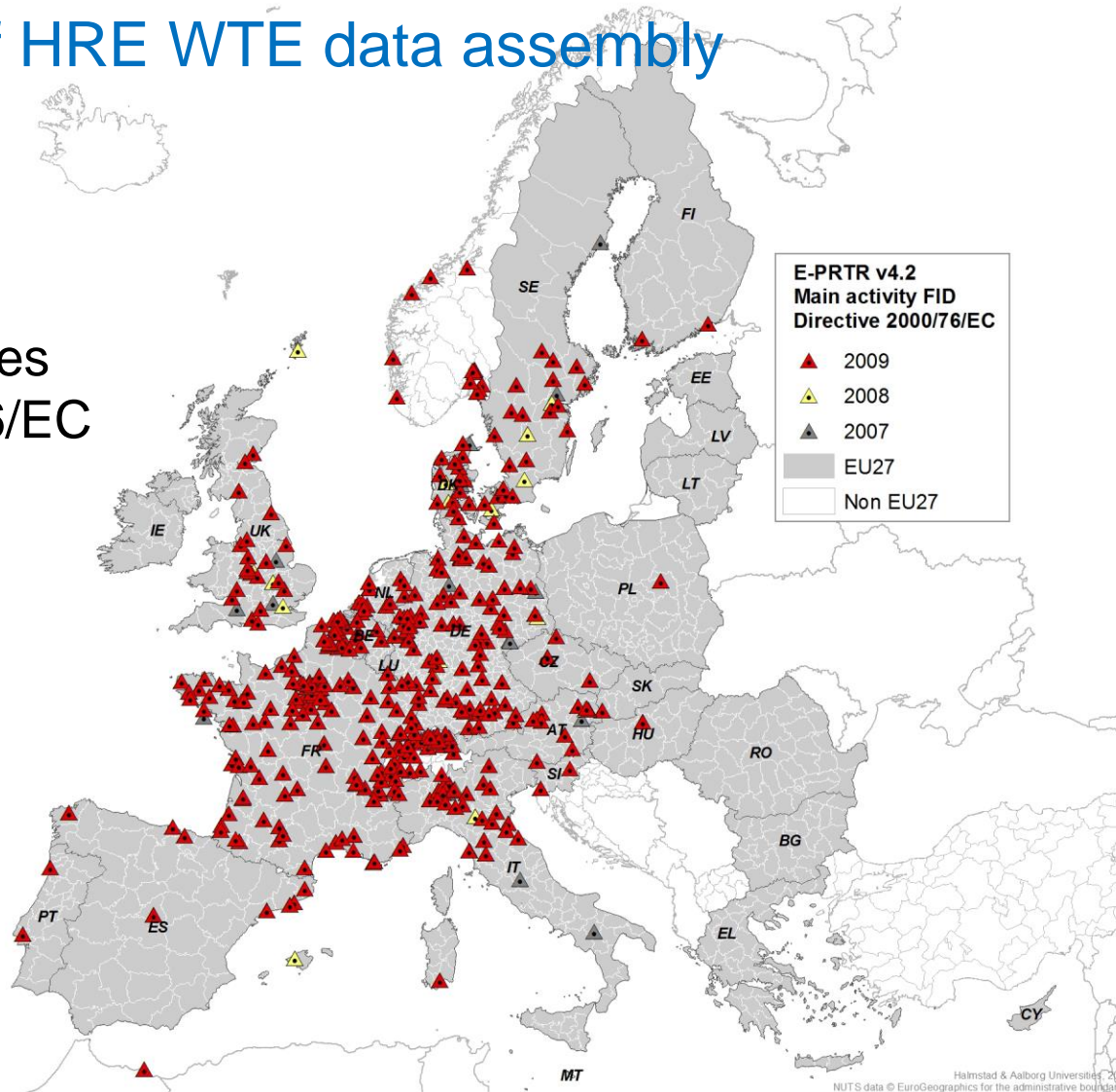
2008
391 facilities
Dir. 2000/76/EC



European Waste-to-Energy facilities

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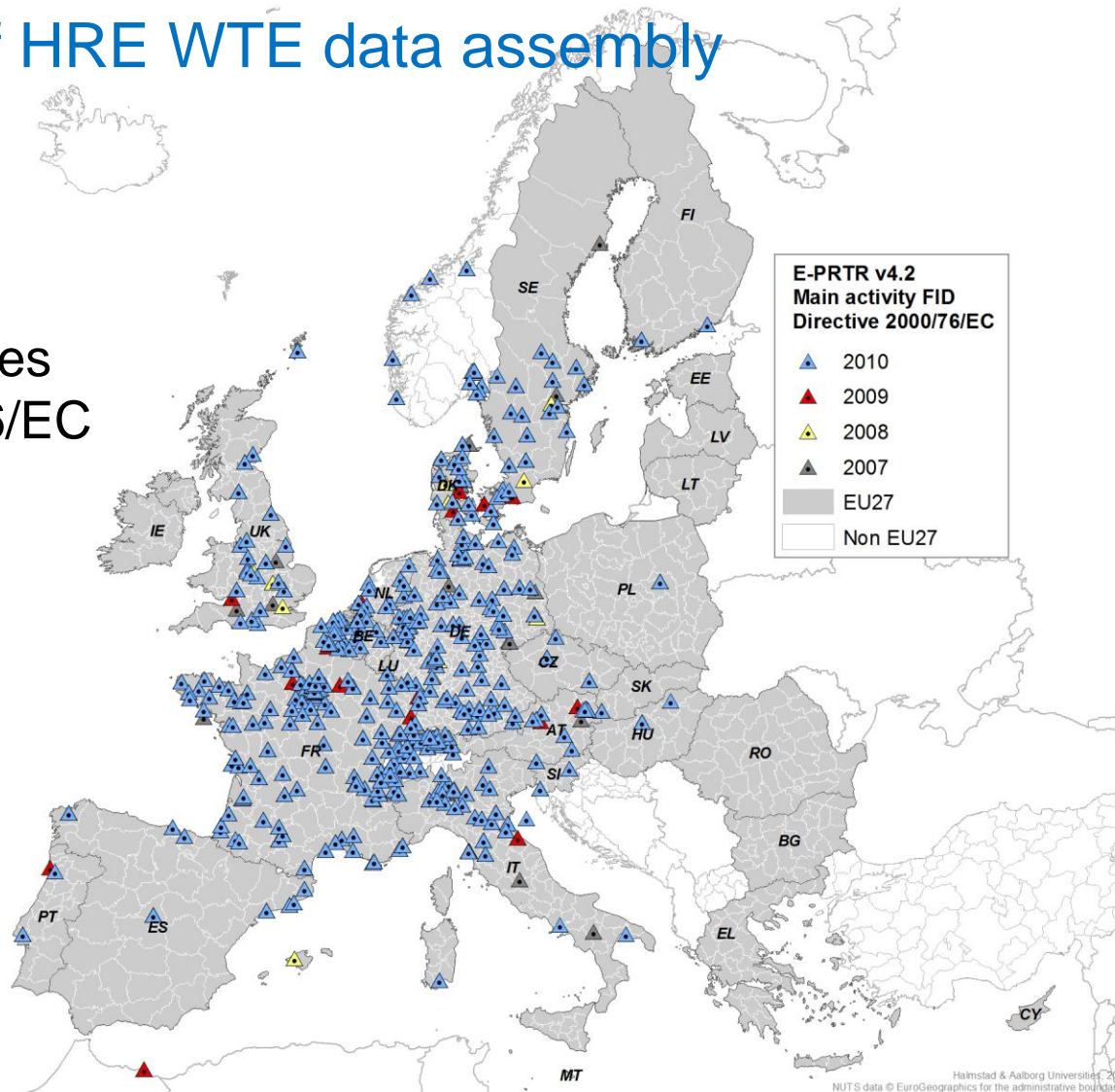
2009
411 facilities
Dir. 2000/76/EC



European Waste-to-Energy facilities

- Review of HRE WTE data assembly

2010
422 facilities
Dir. 2000/76/EC

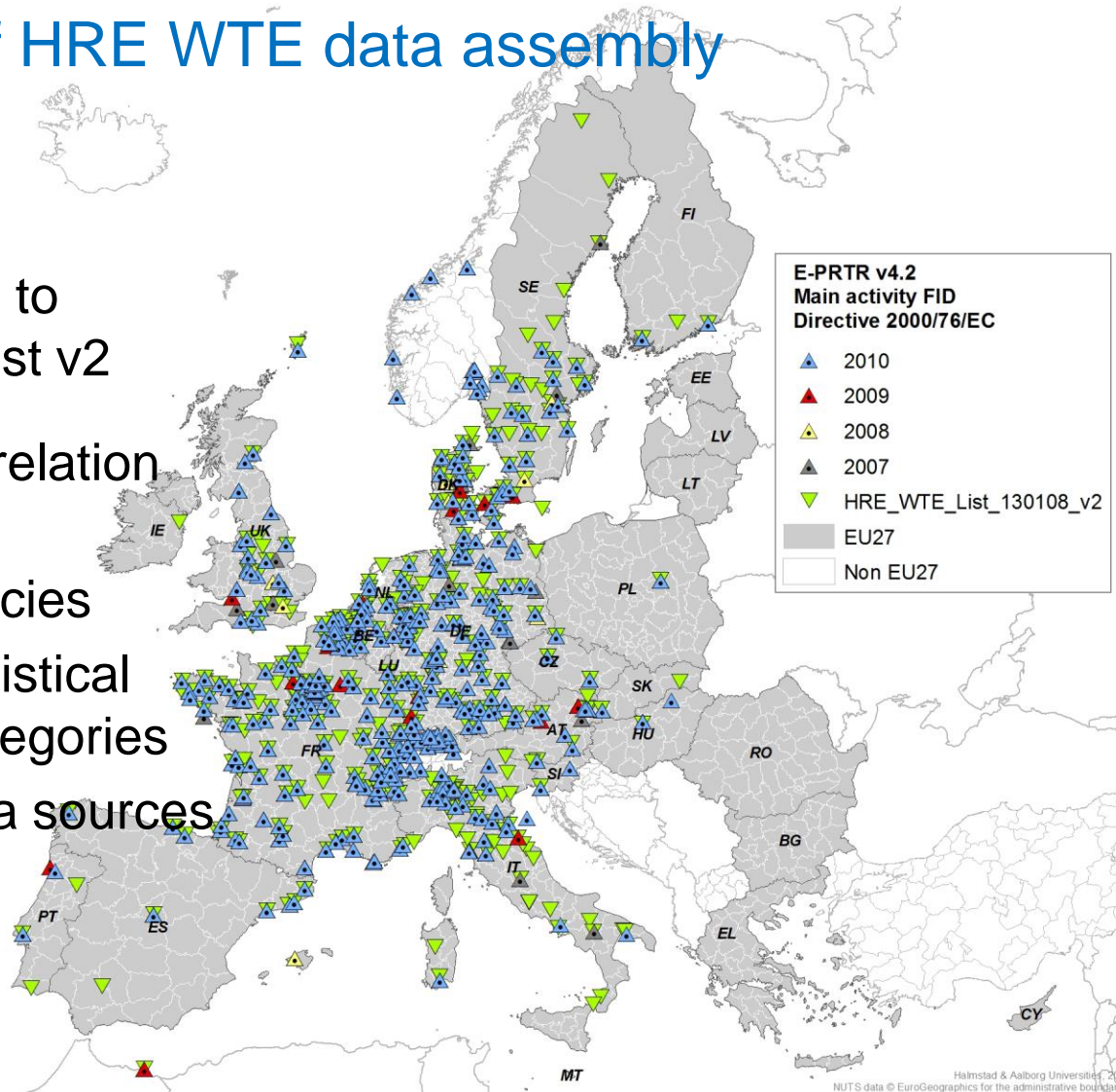


European Waste-to-Energy facilities

- Review of HRE WTE data assembly

Compared to
HRE WTE List v2

- Major correlation
- Partial discrepancies
- Other statistical sector categories
- Other data sources



European Waste-to-Energy facilities

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Geo. coordinate check – spatial analysis in ArcGIS

European Waste-to-Energy facilities

- Review of HRE WTE data assembly

- Geo. coordinate check – spatial analysis in ArcGIS
- Corrected count: **405** HRE WTE List v2 facilities (duplicates removed)
- HRE WTE List v2 facilities versus E-PRTR v4.2
- **Additional** E-PRTR WTE Dir. 2000/76/EC facilities (**87**)

Row Labels	Count of SystemID	Relative shares
Direct match on FID	170	35%
EPTRTR WTE DIR Facility - No match	87	18%
Indirect match by inspection	29	6%
Indirect match by inspection - EPTRTR All Sectors	32	7%
Indirect match by inspection - Multipel FID's	10	2%
Indirect match by spatial join	127	26%
No match	37	8%

Grand Total

2014-03-13

U. Persson. 4DH 2nd PhD Seminar, AAU, Copenhagen

492

100%

European Waste-to-Energy facilities

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 - **Review in autumn 2013**
 - v3: E-PRTR v4.2: Main activity sectors & Directive 2000/76/EC
Geo. coordinate check – spatial analysis in ArcGIS
 - v4: Capacity update (mainly to ISWA 2012 (August, 2012))
Contact with J. Haukohl, Ramböll – ISWA 2012 spread sheets

European Waste-to-Energy facilities

- Establishing compatibility to E-PRTR & ISWA 2012

- **ISWA 2012:**

- 527 facilities (including CH (30), NO (14) & US (86))
 - 397 EU27 facilities in 16 MS, total cap. 69 [Mtpa]

- **Compatibility: NewSystemID in HRE WTE List**

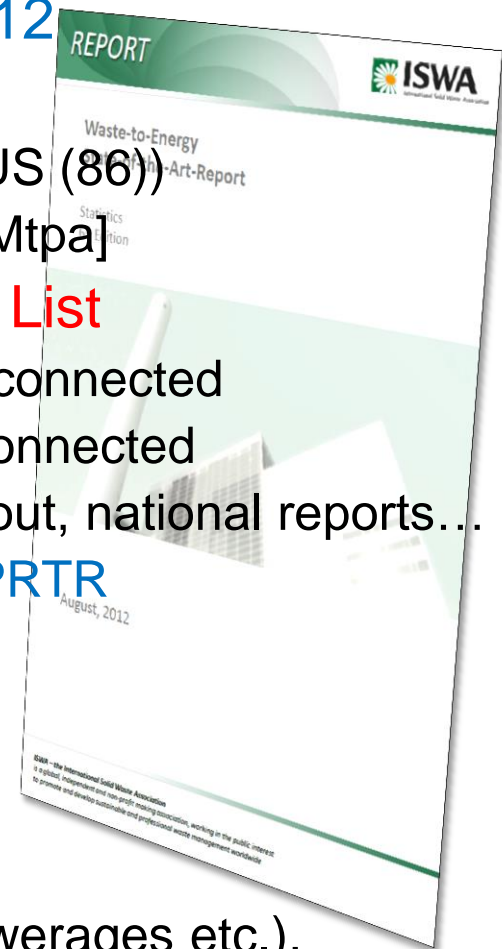
- All ISWA 2012 EU27 facilities identified and connected
 - All E-PRTR Directive 2000/76/EC facilities connected
 - Additional sources: CEWEP CR, IndustryAbout, national reports...
 - Linkage: [ISWA 2012](#) → [HRE WTE List](#) → [E-PRTR](#)

- **Evaluation**

- In operation?
 - With cap. data?

- **The grey area:**

- Parallel sectors: Waste water treatment (sewerages etc.), hazardous waste, industrial waste
 - What is "waste"? Demolition wood? Biomass?



European Waste-to-Energy facilities

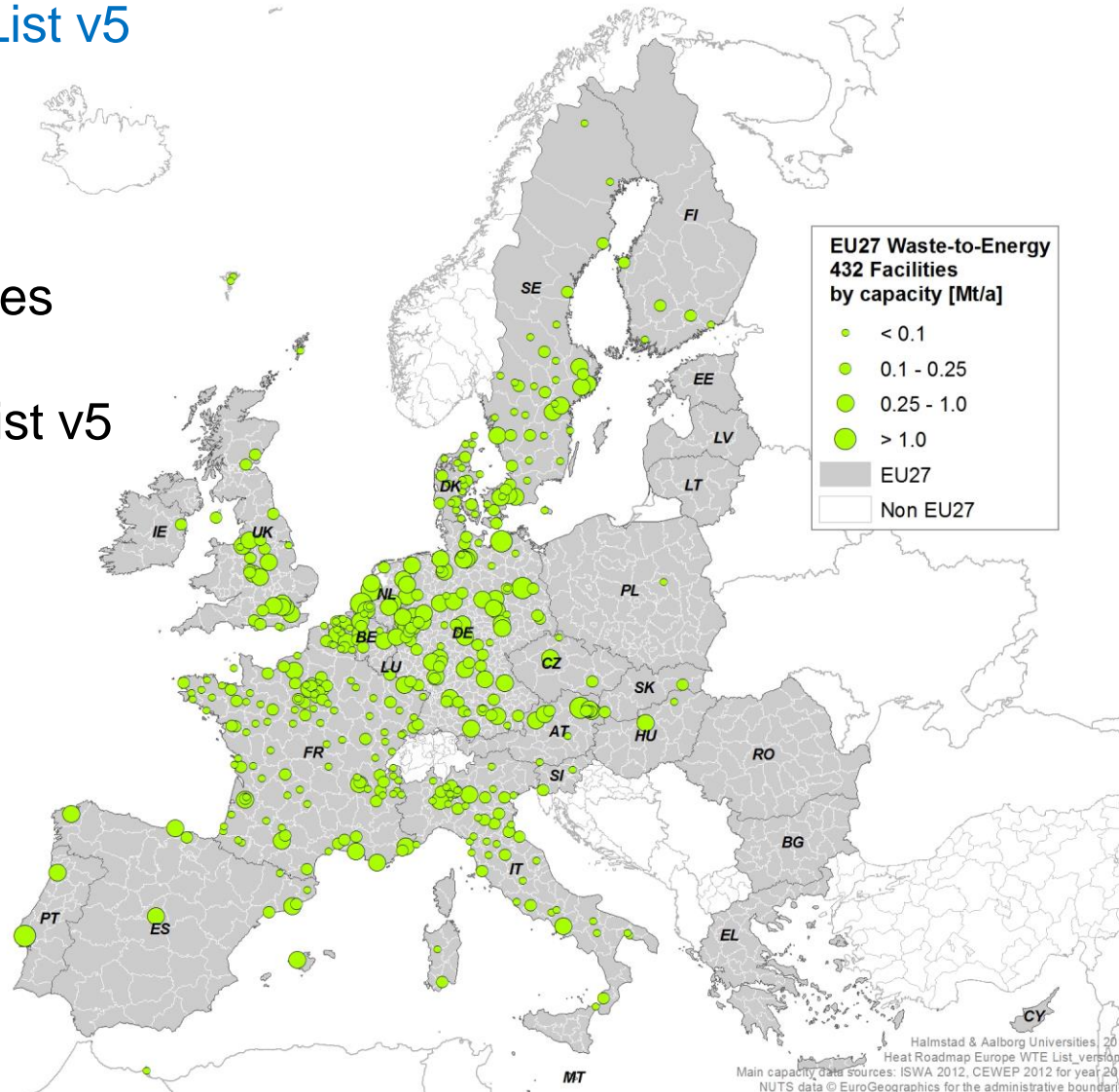
- HRE WTE List v5
 - Fifth version (v5) in October, 2013
 - 562 European facilities in 21 countries (including NO & CH)
 - 487 (87%) with cap. data (data year mainly 2010)
 - Total cap. ~93 [Mtpa]
 - 432 EU27 facilities in operation
 - 432 (100%) with cap. data (data year mainly 2010)
 - Total cap. ~87 [Mtpa]
 - 403 (93%) with FacilityID & geo. coordinates from E-PRTR
 - All 397 ISWA EU27 facilities included

European Waste-to-Energy facilities

- HRE WTE List v5

432 facilities

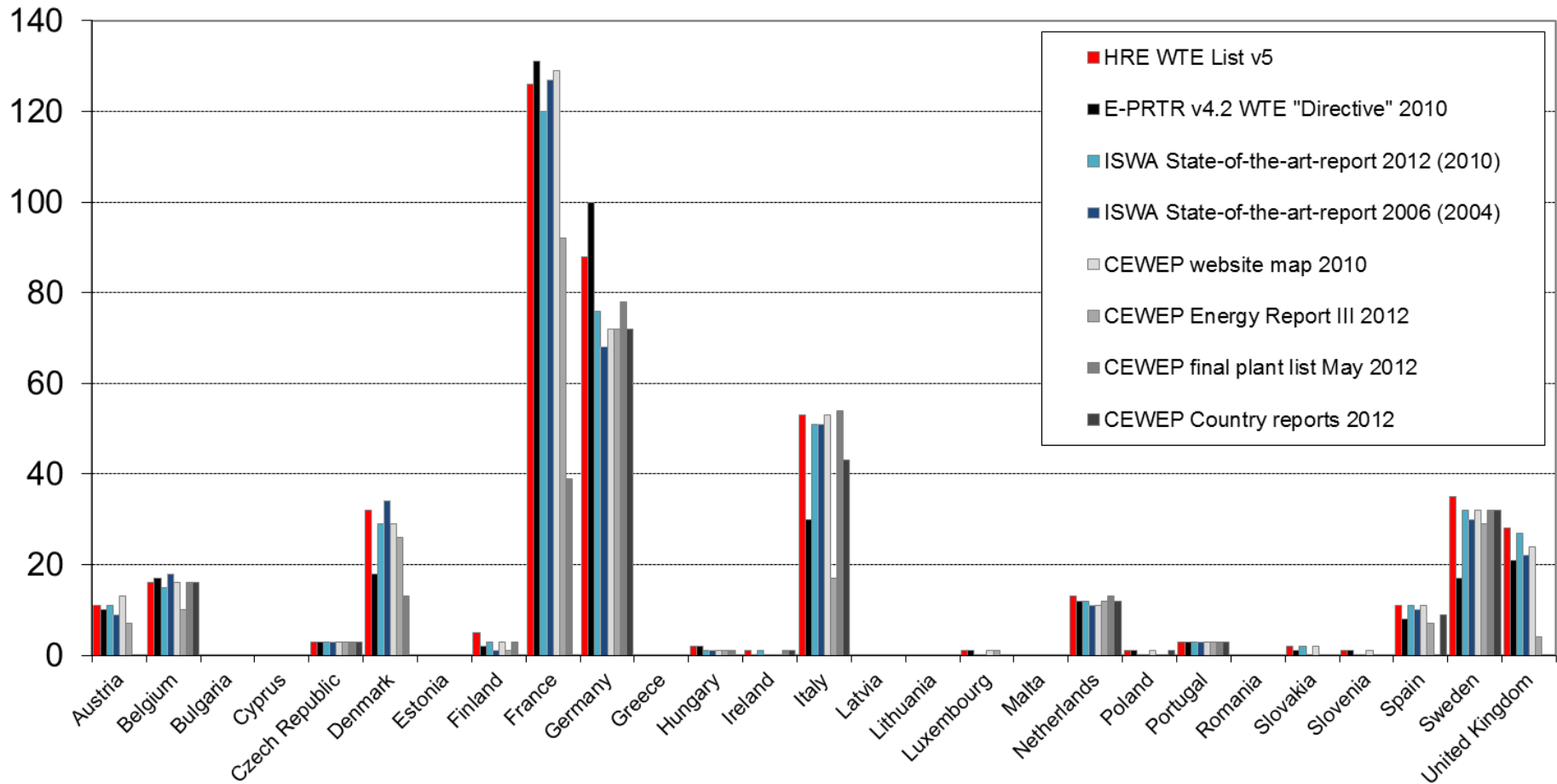
HRE WTE List v5



European Waste-to-Energy facilities

- HRE WTE List v5

Overview of number of WTE-plants within EU27 by country - In operation

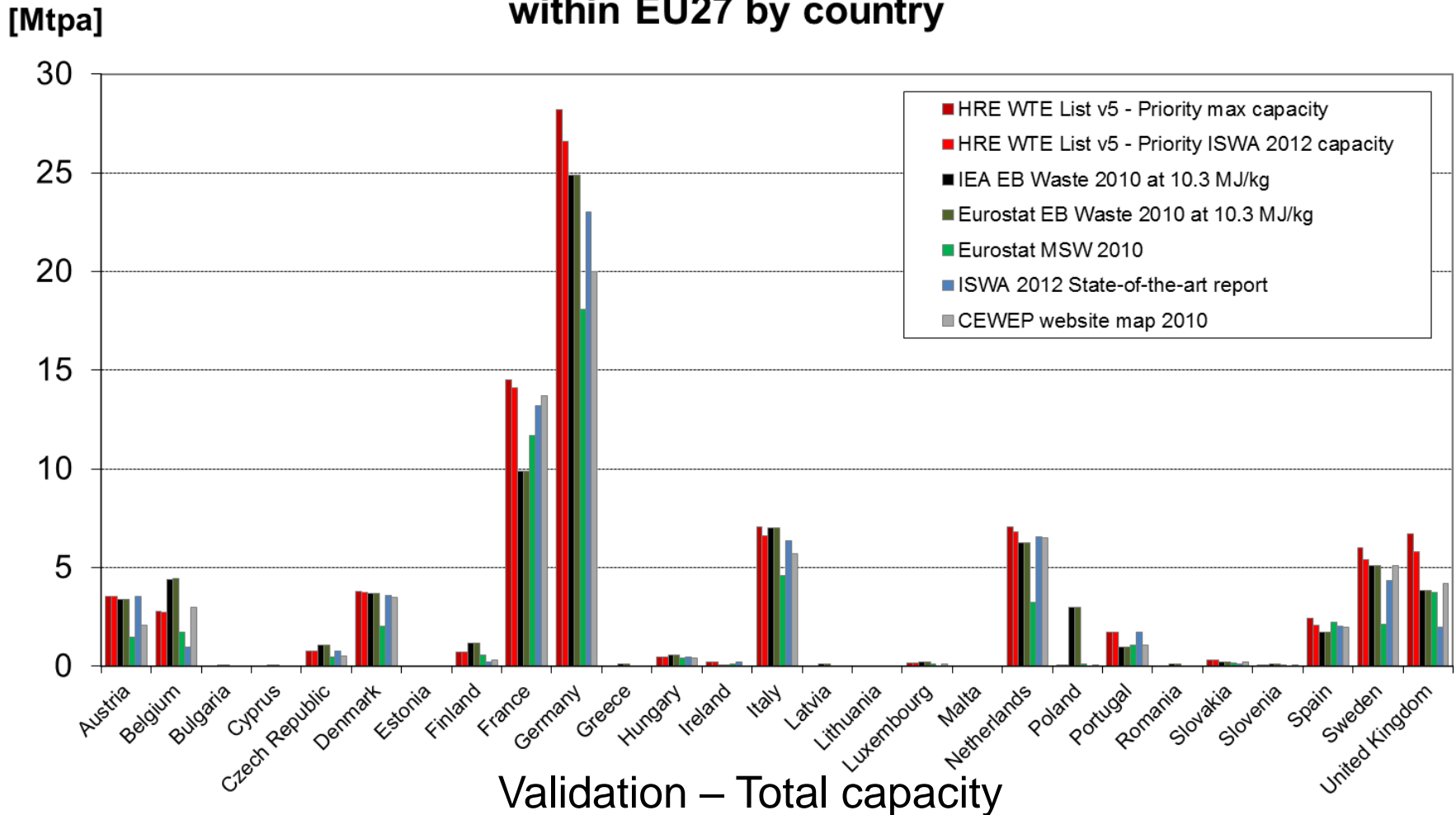


Validation – Total count

European Waste-to-Energy facilities

- HRE WTE List v5

EU27 Incineration capacity of waste incineration within EU27 by country



European Waste-to-Energy facilities

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 - 487 (87%) with cap. data (data year mainly 2010)
 - Total cap. ~93 [Mtpa]
 - 432 EU27 facilities in operation
 - 432 (100%) with cap. data (data year mainly 2010)
 - Total cap. ~87 [Mtpa]
 - 403 (93%) with FacilityID & geo. coordinates from E-PRTR
 - All 397 ISWA EU27 facilities included
 - **Extract from HRE WTE list v5 to HRE mapping paper**
 - **410** EU27 facilities in op. (excl. 16 co-firing plants & 6 non-NUTS3)
 - 410 (**100%**) with cap. data (data year mainly 2010)
 - Total cap. ~**82** [Mtpa]
 - 386 (94%) with FacilityID & geo. coordinates from E-PRTR
 - 379 (95%) of ISWA EU27 facilities included

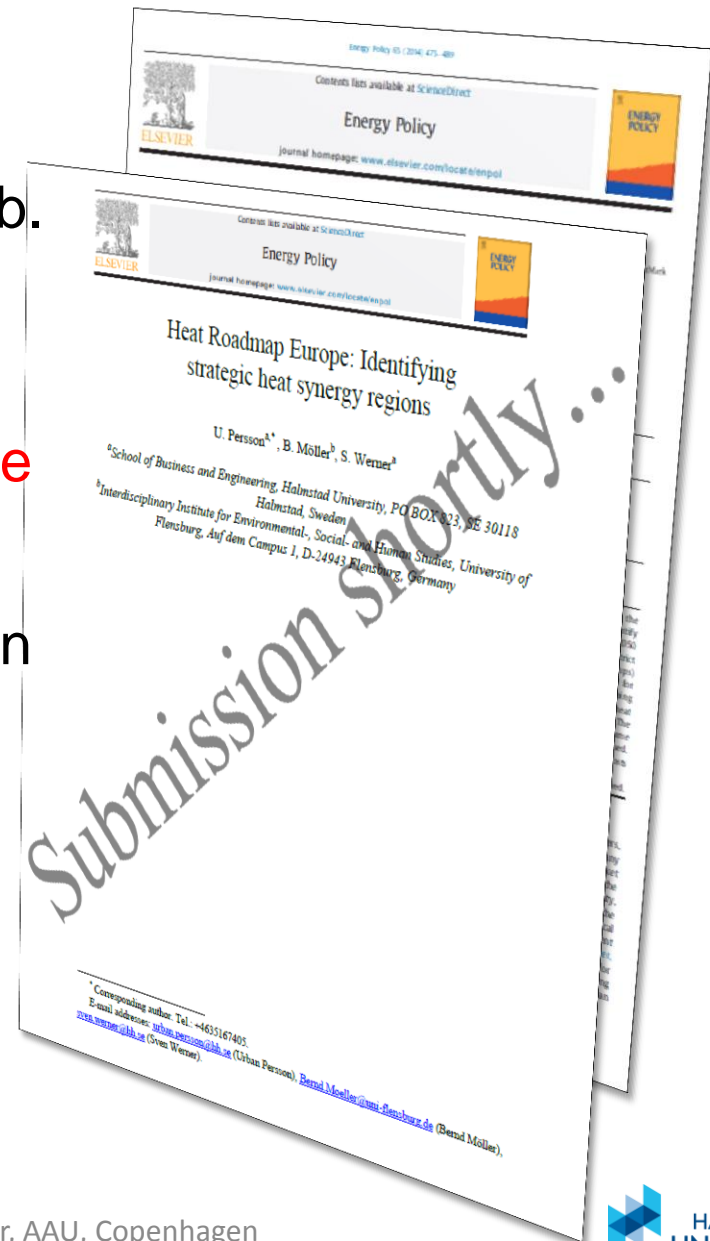
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Heat Roadmap Europe – Mapping paper

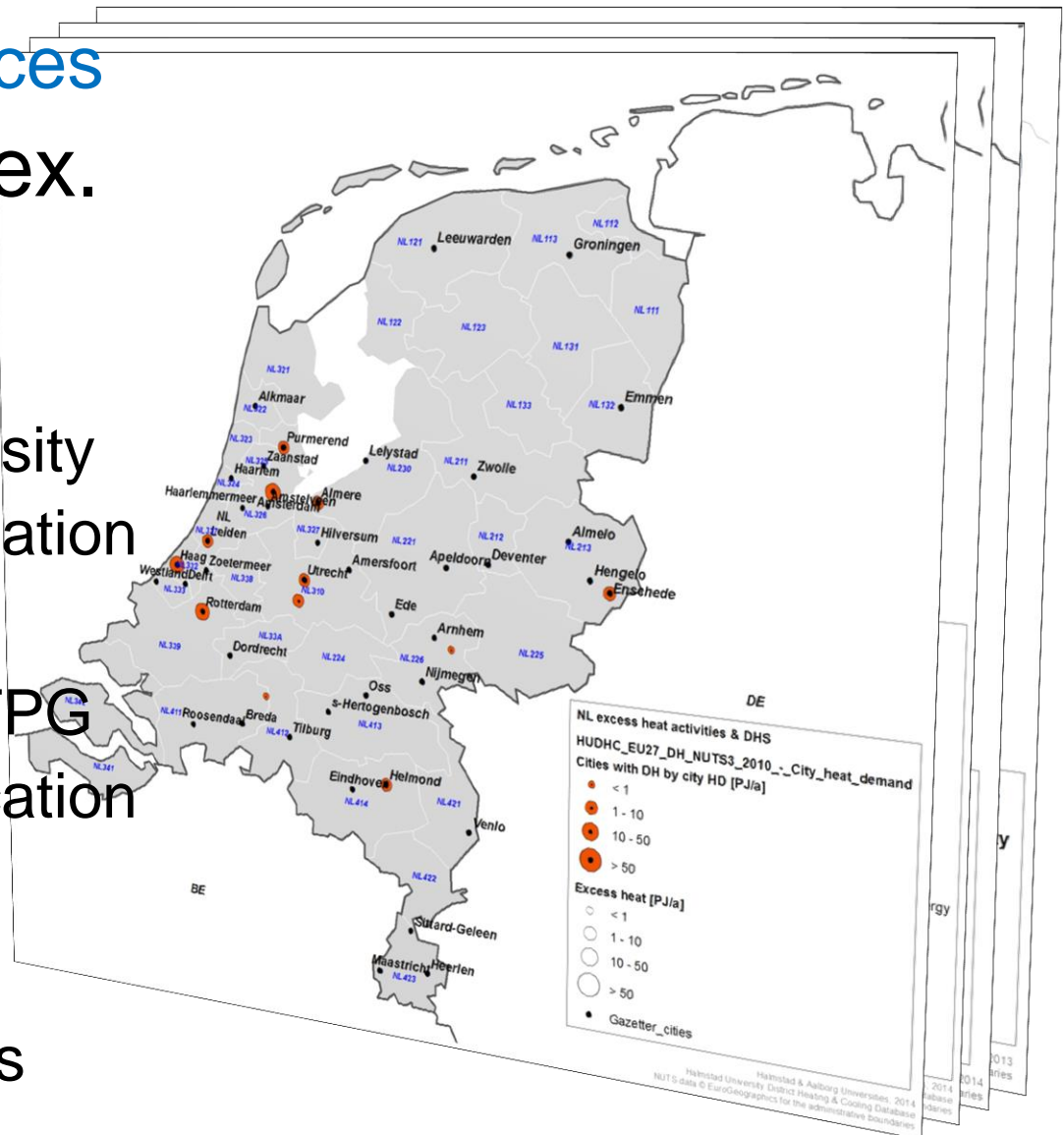
- Brief background

- 1st HRE paper **published** in Energy Policy, volume 65, Feb. 2014
- Focus on main study and modelling results
- HRE methodology: to **combine** mapping and modelling
- 2nd paper in preparation for **submission** to Energy Policy in April/May, 2014
- Methods, theory, and data to quantify EU **regional heat balances**
- Identification of **strategic heat synergy regions**



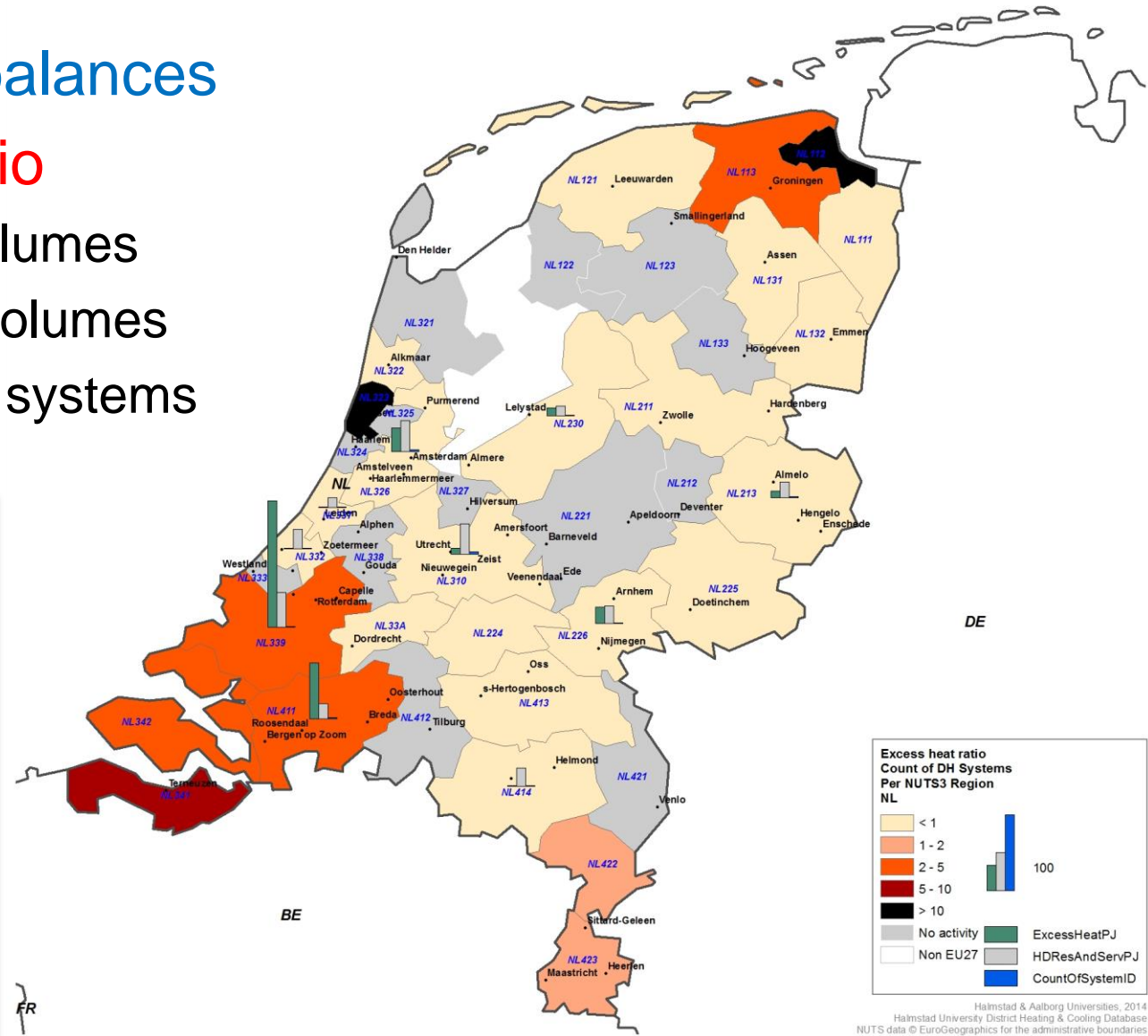
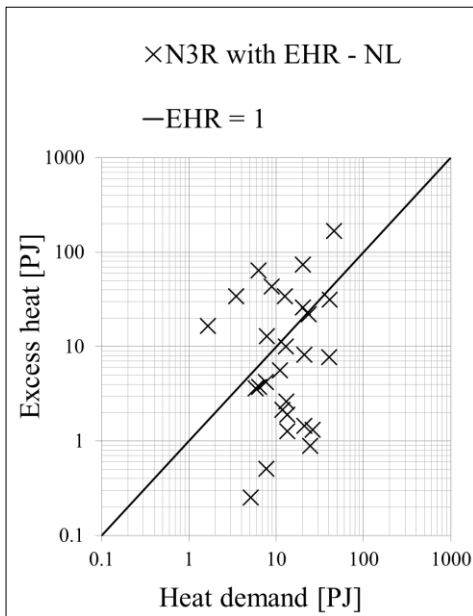
Heat Roadmap Europe – Mapping paper

- Regional heat balances
 - Local conditions (ex. NL)
 - Heat demand
 - Heat demand density
 - Regional accumulation
 - Excess heat
 - 6 Ind. Sectors & TPG
 - Regional quantification
 - District heating
 - Cities with DH
 - City heat demands



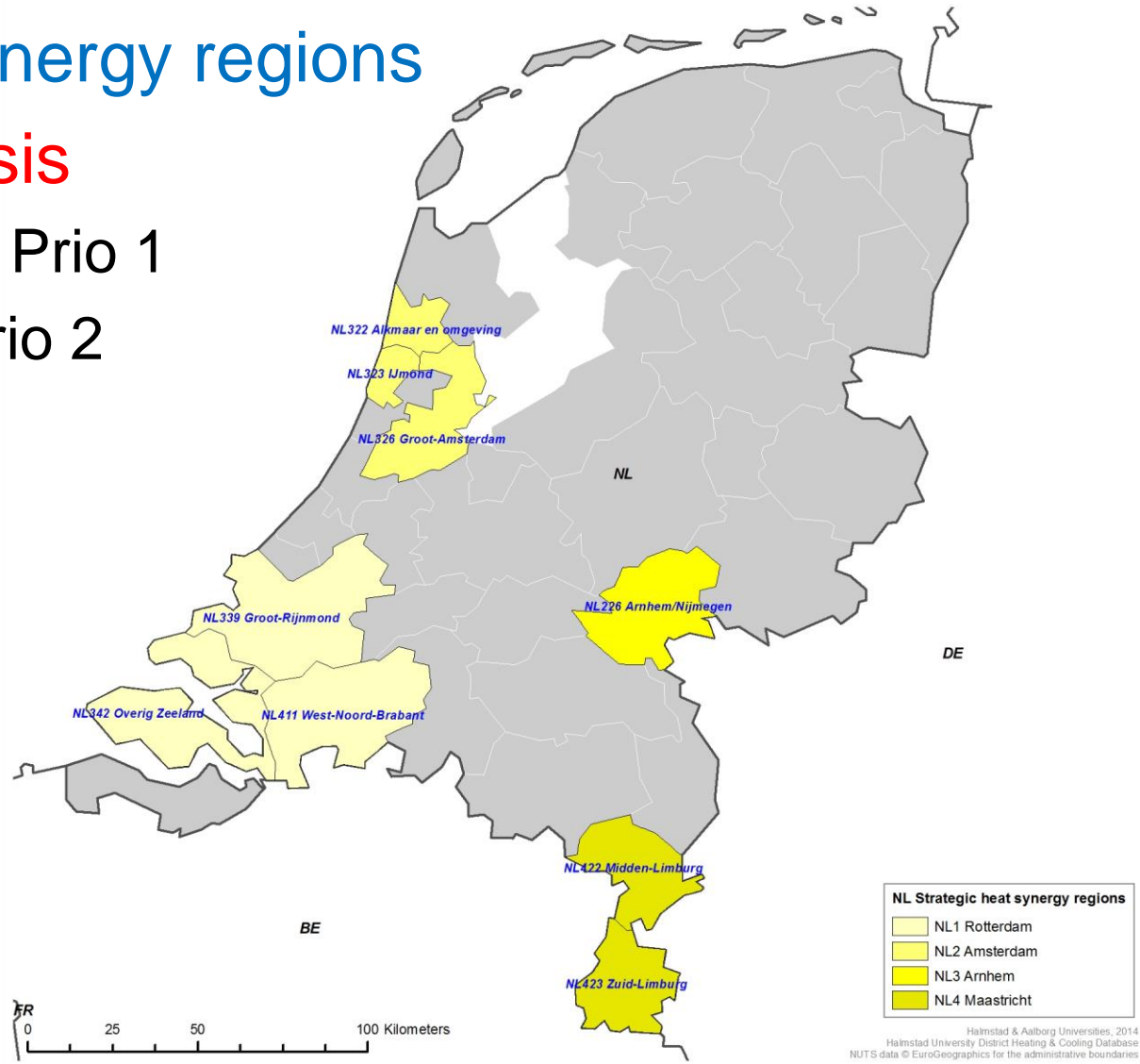
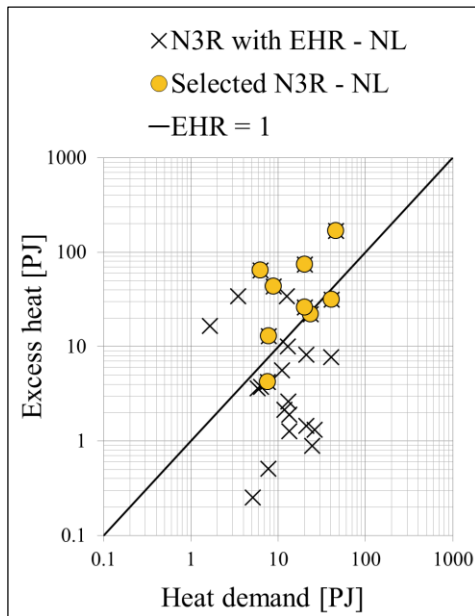
Heat Roadmap Europe – Mapping paper

- Regional heat balances
- Excess heat ratio
 - Excess heat volumes
 - Heat demand volumes
 - District heating systems



Heat Roadmap Europe – Mapping paper

- Strategic heat synergy regions
 - Multi-layer analysis
 - Heat demands – Prio 1
 - Excess heat – Prio 2
 - District heating?



Heat Roadmap Europe – Mapping paper

- Strategic heat synergy regions

- Multi-layer analysis performed for EU27
- Selection criteria by current DH integration level

- **Expansion** (AT, DE, FR, IT, SI)
 - Medium integration level
- **New Development** (BE, IE, LU, NL, UK) 16 MS
- **Refurbishment** (BG, CZ, HU, PL, RO, SK) Included
- **Developed** (DK, SE, FI, EE, LV, LT) 11 MS
- **Out-of-scope** (ES, PT, MT, CY, EL) Excluded

Heat Roadmap Europe – Mapping paper

• Strategic heat synergy region

– EU27

– N3R: **1281** (100 %)

– HD: **11.7 EJ** (100 %)

– EU27 with EHR

– N3R: **834** (65 %)

– PES: **26.1 EJ** (100 %)

– HD: **9.5 EJ** (81 %)

– EH: **11.3 EJ** (100 %)

– 16 MS Selected

– N3R: **694** (54 %)

– PES: **21.4 EJ** (82 %)

– HD: **7.9 EJ** (68 %)

– EH: **9.3 EJ** (82 %)

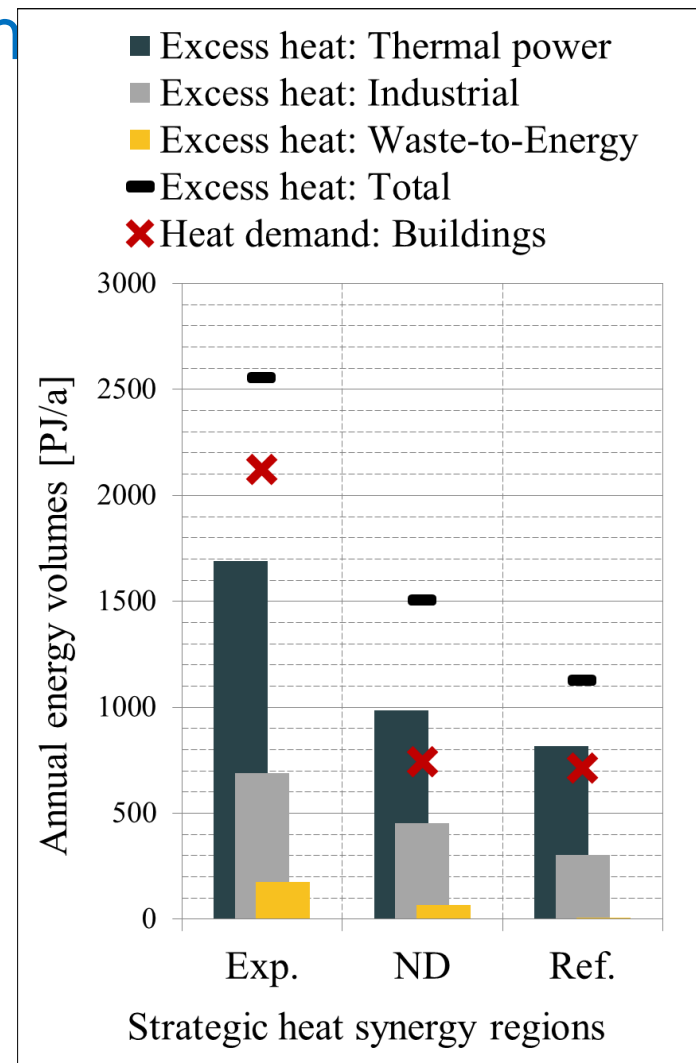
– 16 MS SHSR

– N3R: **206** (16 %)

– PES: **11.9 EJ** (46 %)

– HD: **3.6 EJ** (31 %)

– EH: **5.2 EJ** (46 %)



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Input to 3rd 4DH Conference

- In-depth account for HRE – Mapping paper
 - Methodology and data
 - Data validation (CO2, PES etc.)
 - Study results & linkage to modelling
 - Close-up on identified Strategic Heat Synergy Regions
 - Expansion: 5 MS 114 N3R 22 SHSR
 - New Development: 5 MS 45 N3R 18 SHSR
 - Refurbishment: 6 MS 47 N3R 23 SHSR
 - Two conf. papers for 14DHC in Stockholm (Sept. '14)
 - "Towards 4th generation DHS: Case study experiences"
 - "On the use of surplus electricity in district heating systems"
 - Swedish experiences from large scale HP in DHS!

Thank You!
Questions...