



Biomass potential and its deployment opportunities in countries of the Baltic Sea Region

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PRESENTATION PLAN

1. Biomass potential in selected sectors

- General data
- Forest biomass
- Agricultural biomass
 - Straw potential
 - Dedicated perennial crops plantations
 - Manure and slurry
- Municipal waste and sewage sludge

2. Bioenergy technologies

- General data on bioenergy
- Pellets
- Residential and derived bioheat
- Biogas
- Bioelectricity
- Liquid biofuels
- Incineration plants

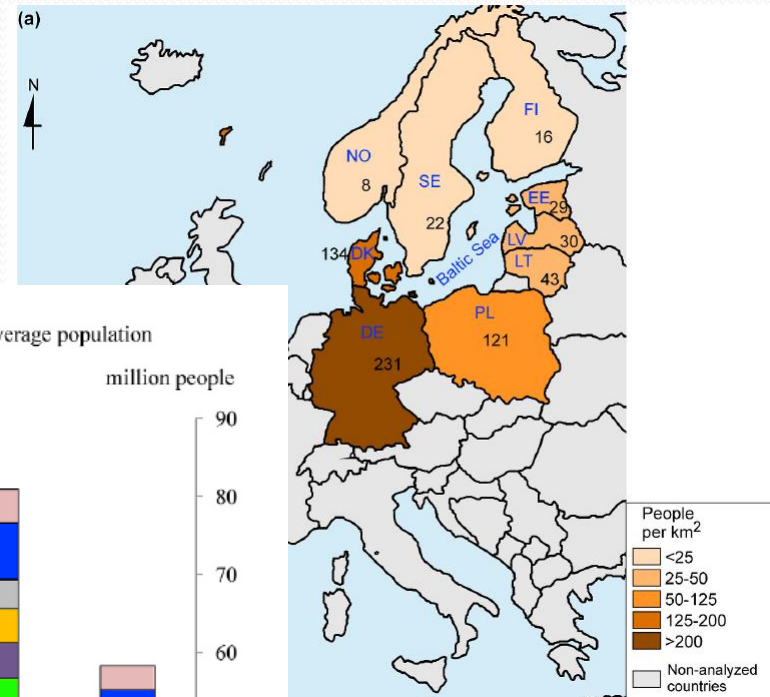
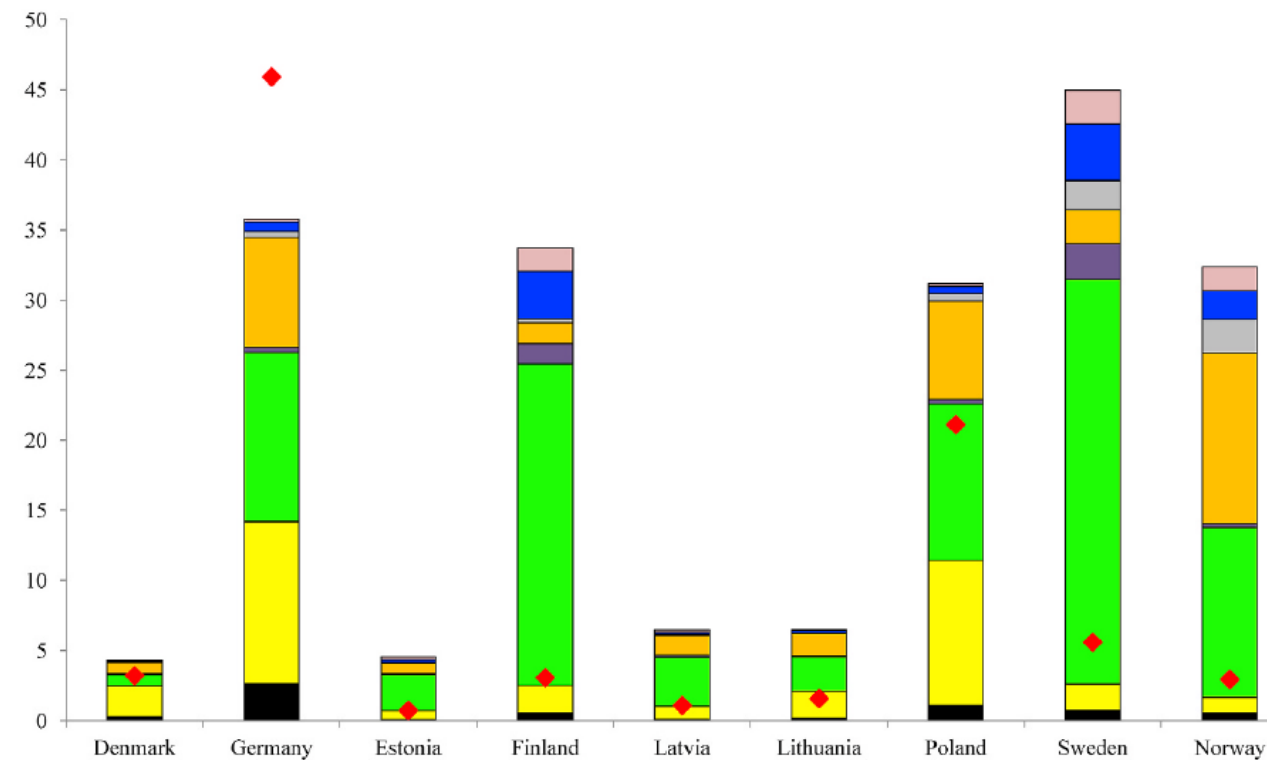
3. Conclusions

Characterisation of land use and populations in the BSR countries

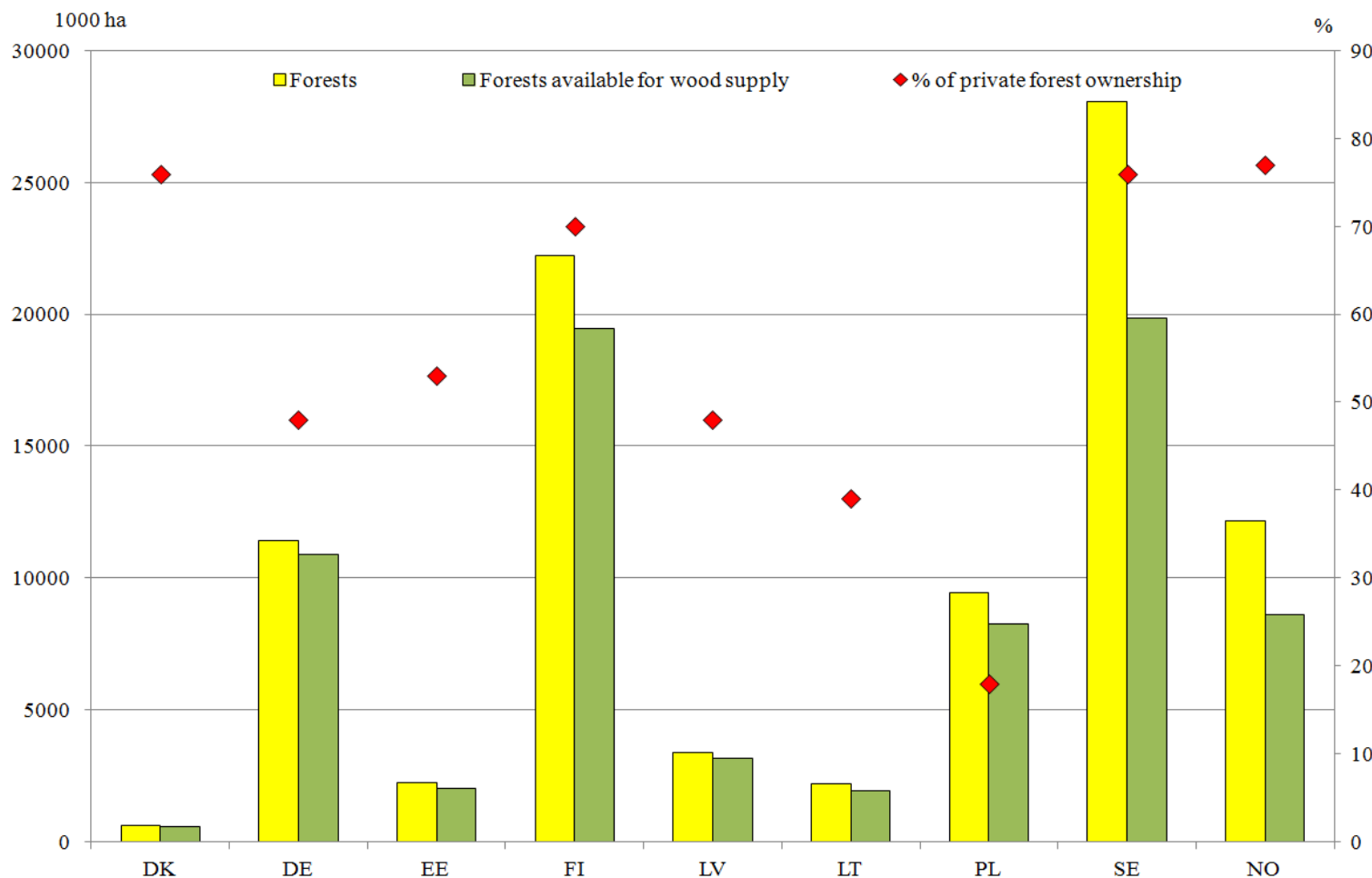
(b)

■ Artificial land ■ Cropland ■ Woodland ■ Shrubland ■ Grassland ■ Bare land ■ Water ■ Wetland ◆ Average population

million ha

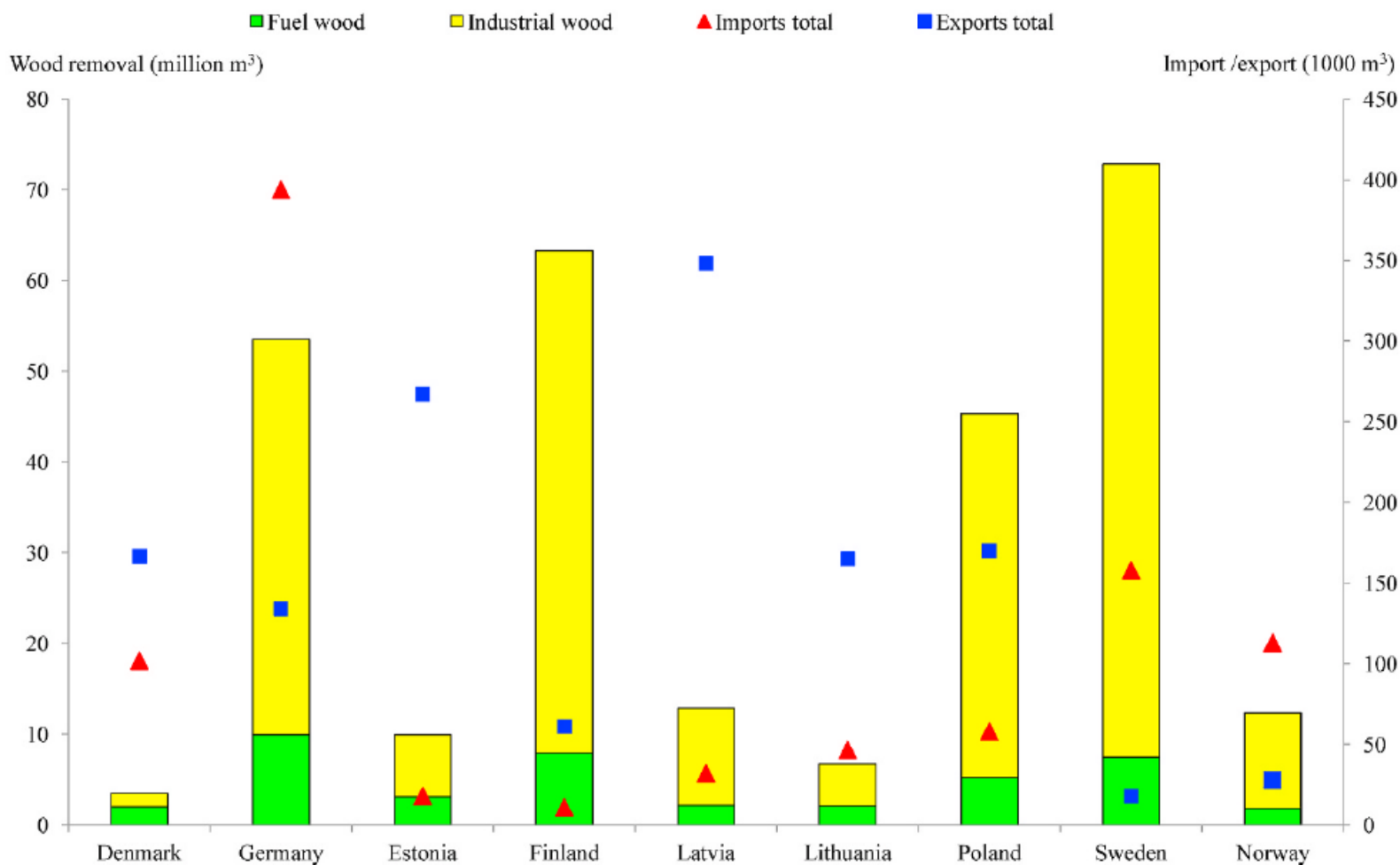


Forest area, forests available for wood supply and % of private forest ownership



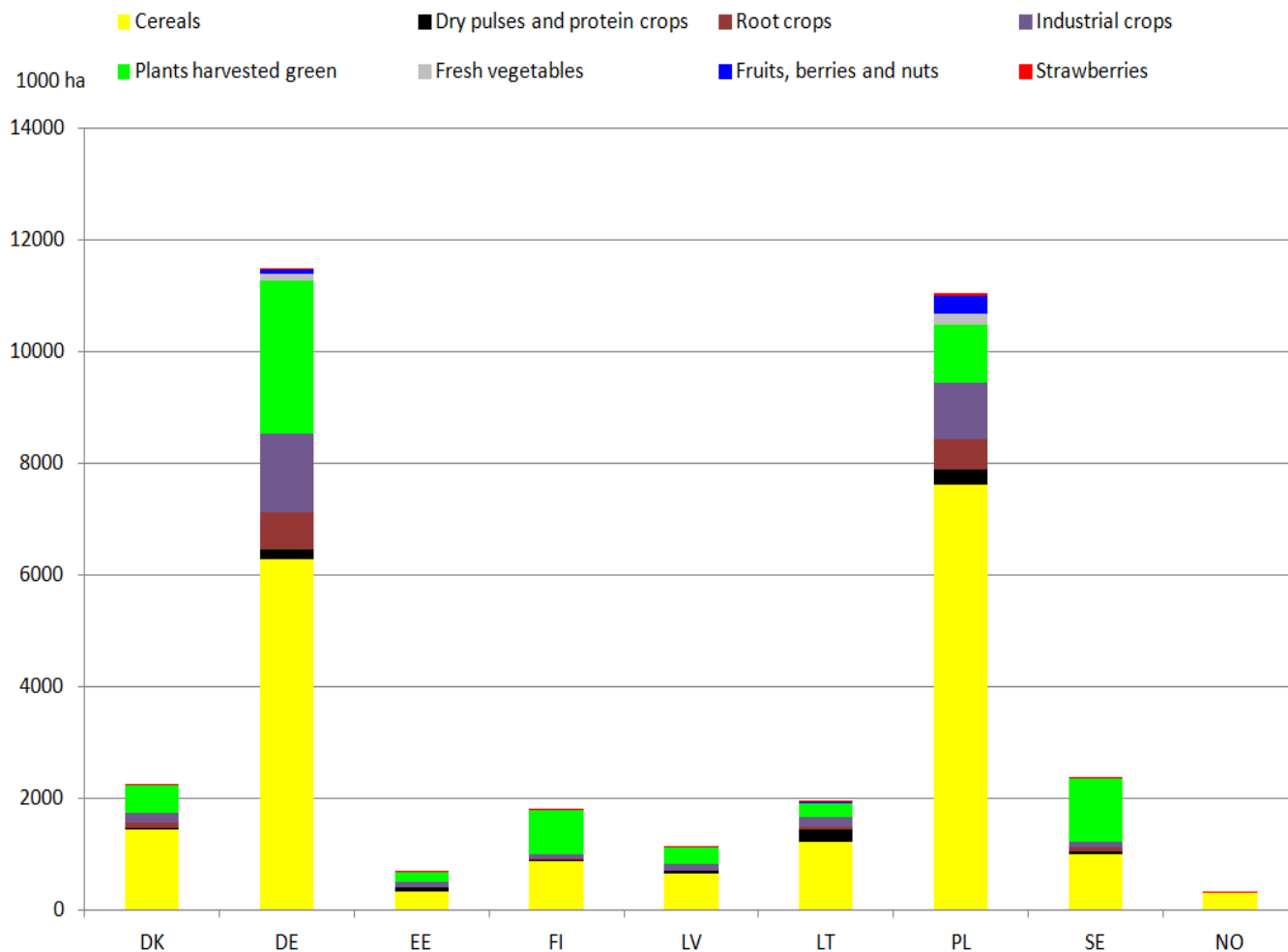
Source: Stolarski et al. 2020a, BB4V report

Fuel and industrial wood removals from forests and fuel wood import and export (including wood for charcoal) in BSR countries



Source: Stolarski et al. 2020, Renewable and Sustainable Energy Reviews 133 (2020) 110238

Area cultivation of major agricultural crops in the BSR countries (1000 ha)



Source: Stolarski et al. 2020a, BB4V report

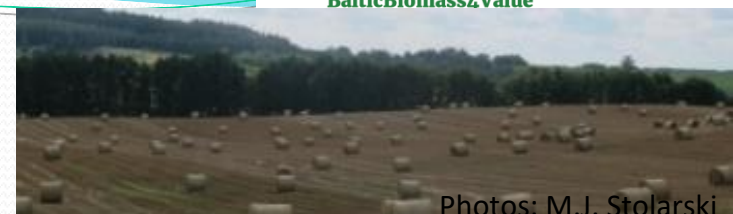


Photo: M.J. Stolarski



Photo: M.J. Stolarski

Theoretical and technical potential of straw from cereal and oilseed crops in BSR countries



Photos: M.J. Stolarski



Technical potential of straw (million Mg)

8

7.0

6.0

5.0

4.0

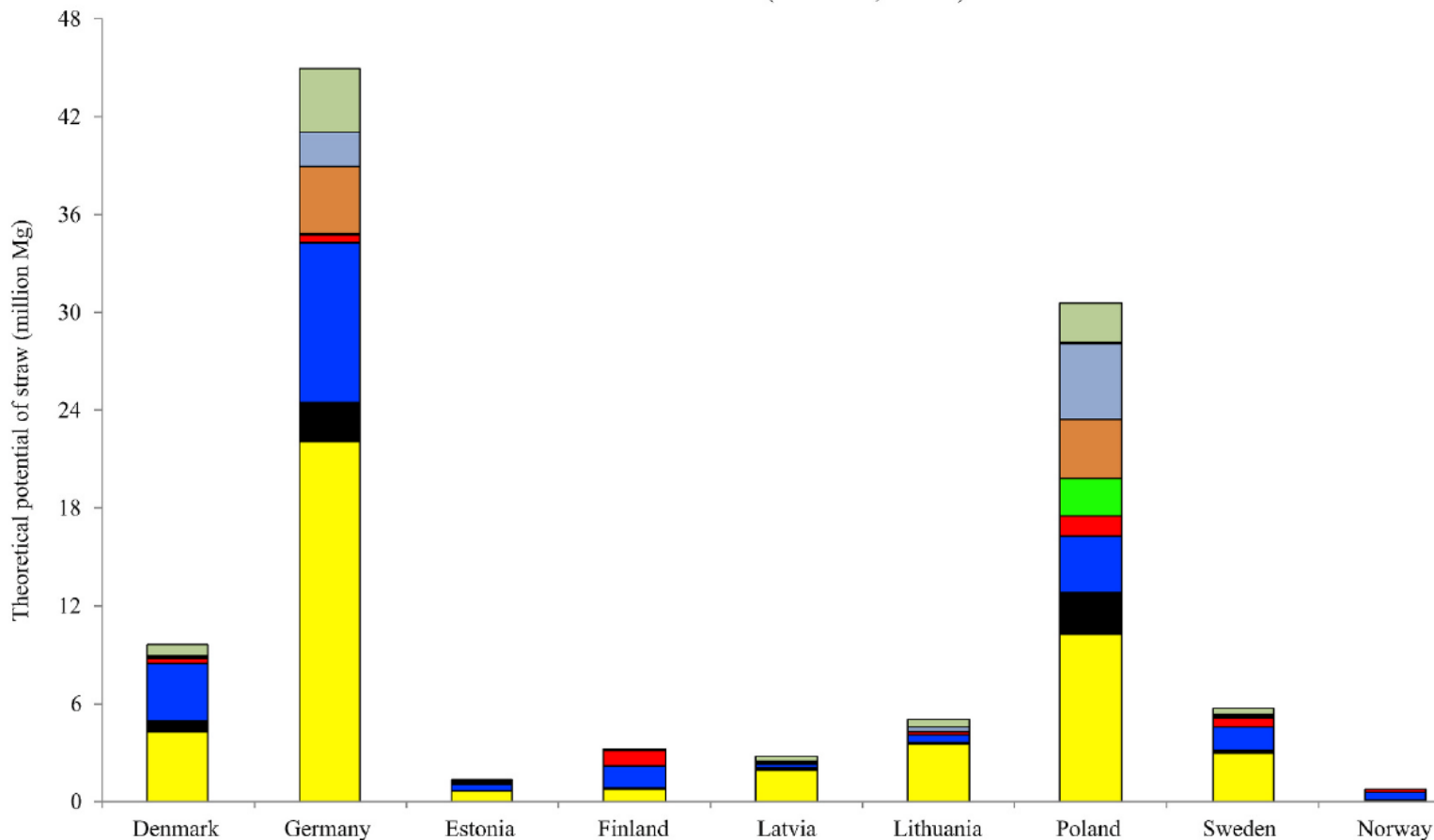
3.0

2.0

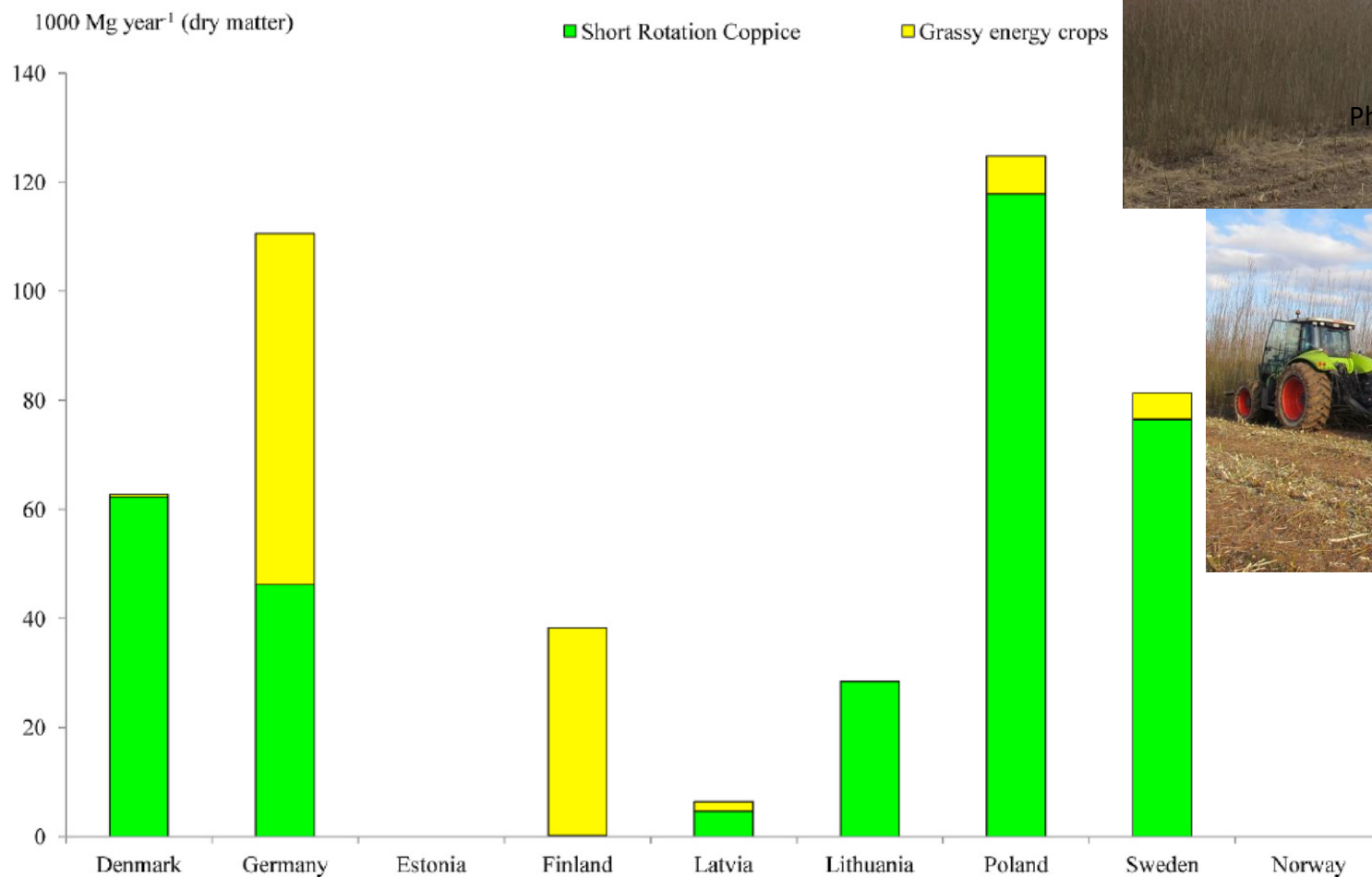
1.0

0

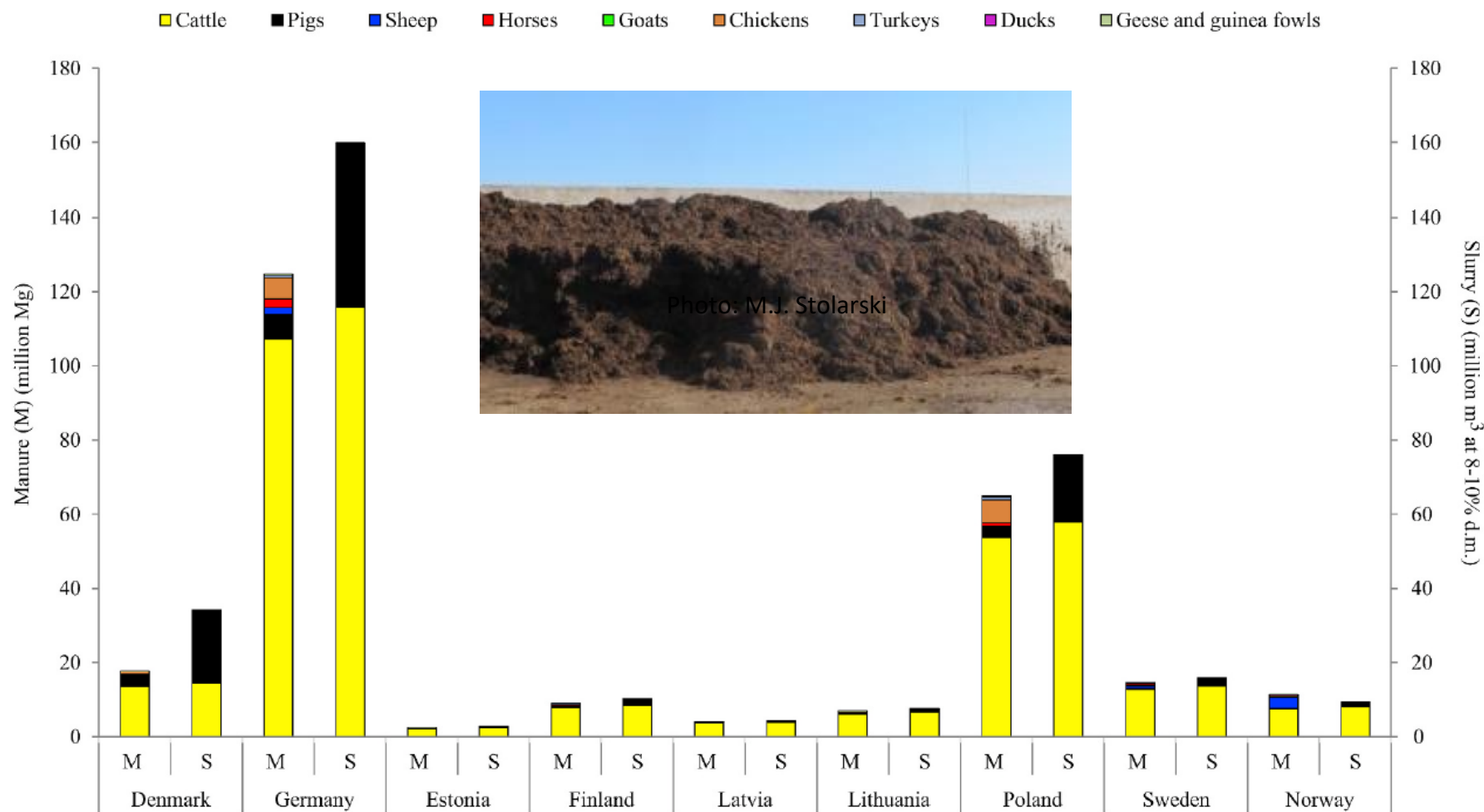
- Wheat and spelt
- Oats
- Triticale
- Rye and winter cereal mixtures
- Spring cereal mixtures
- Other cereals (buckwheat, millet...)
- Barley
- Grain maize and corn-cob-mix
- Oilseeds



Theoretical potential of biomass from dedicated perennial energy crops in BSR countries



Theoretical potential of manure and slurry in BSR countries



Municipal waste by waste operation and sewage sludge disposal from wastewater treatment plants in Baltic Sea region countries

Operation/disposal	Countries								
	Denmark	Germany	Estonia	Finland	Latvia	Lithuania	Poland	Sweden	Norway
Municipal waste operation (1000 Mg year ⁻¹)									
Disposal – landfill and other	38	451	98	26	518	421	5000	20	137
Disposal – incineration	0	612	0	0	0	0	198	0	0
Recovery – energy recovery	2355	15,946	217	1646	21	236	2724	2400	2088
Recycling – material	1282	25,355	127	771	141	311	3199	1426	1138
Recycling – composting and digestion	834	9429	19	369	57	308	848	704	395
Total	4509	51,793	461	2812	737	1276	11,969	4550	3758
Sewage sludge disposal (1000 Mg year ⁻¹ d.m.)									
Agricultural use	0	428	0.3	0	4.7	11	127	60	71
Compost and other applications	0	224	16	0	6.1	16	48	0	21
Landfill	0	0	2.4	0	0.4	0	132	0	20
Incineration	0	1149	0	0	0	0	165	0	0
Other	0	3.0	14	0	12	0	480	0	3.3
Total	0	1803	34	0	23	27	952	60	114



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Unlocking the Potential of Bio-based Value Chains in the Baltic Sea
Region "BalticBiomass4Value" BB4V

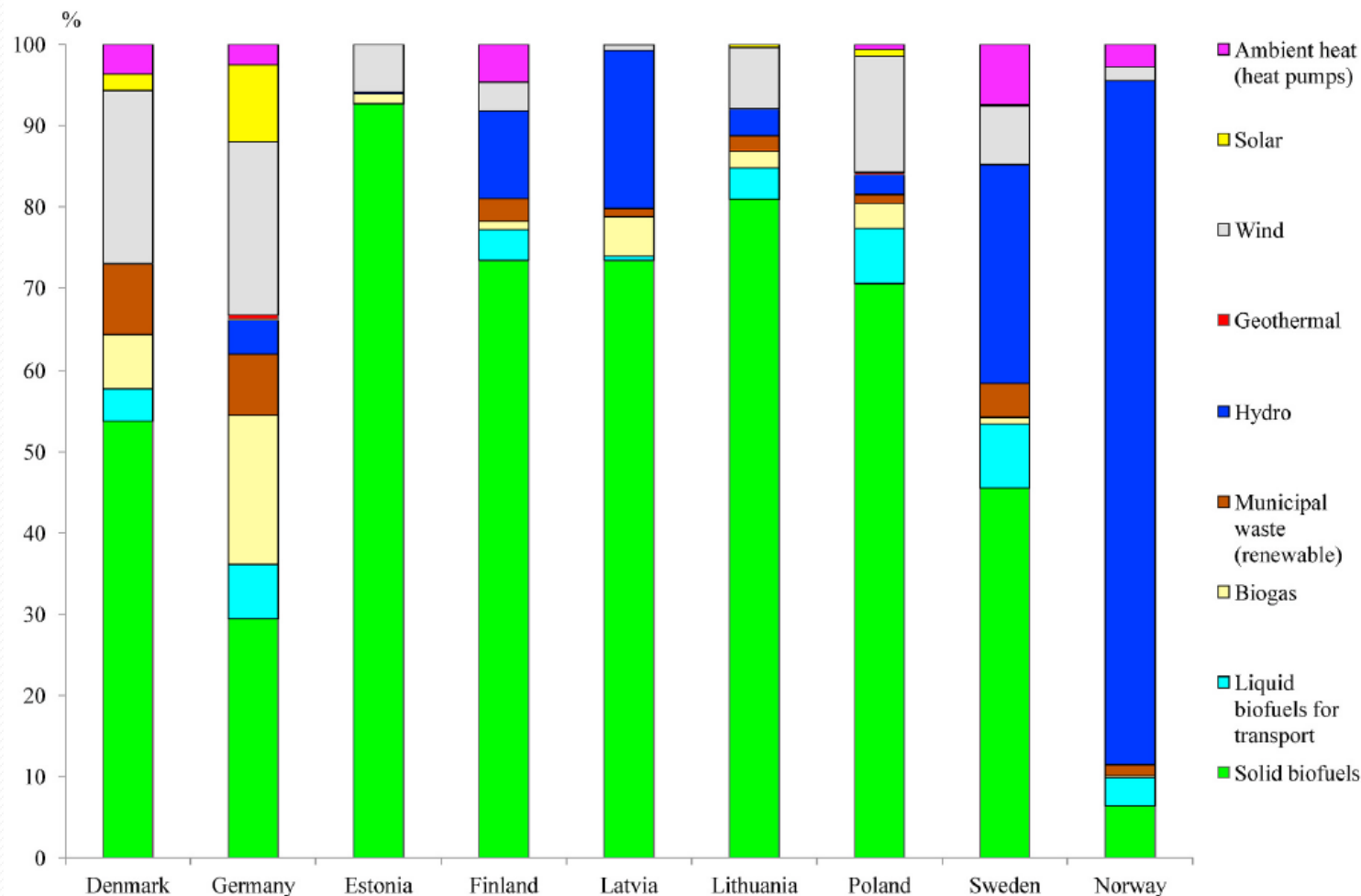
 **Interreg**
Baltic Sea Region



BalticBiomass4Value

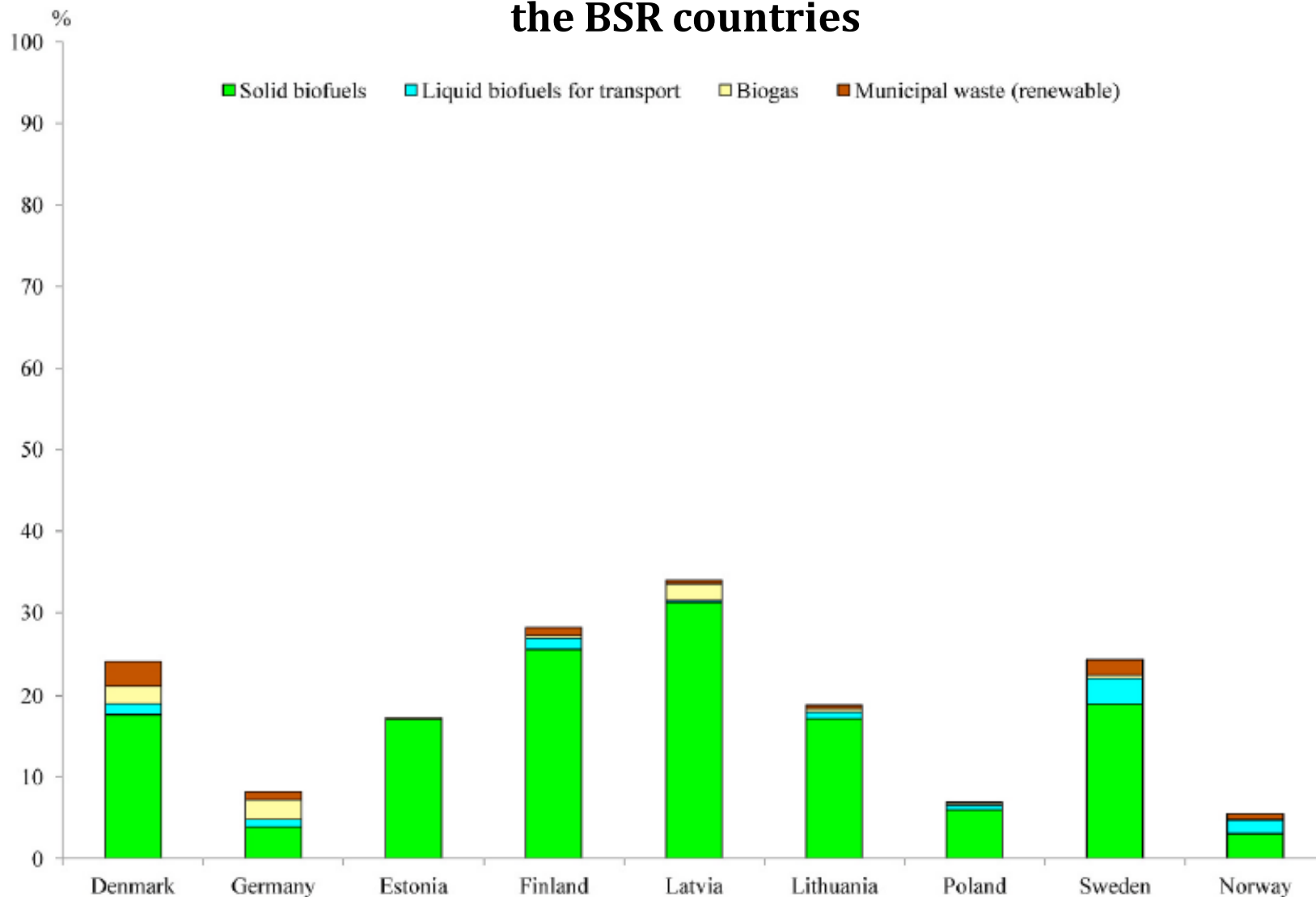
Bioenergy technologies in BSR countries

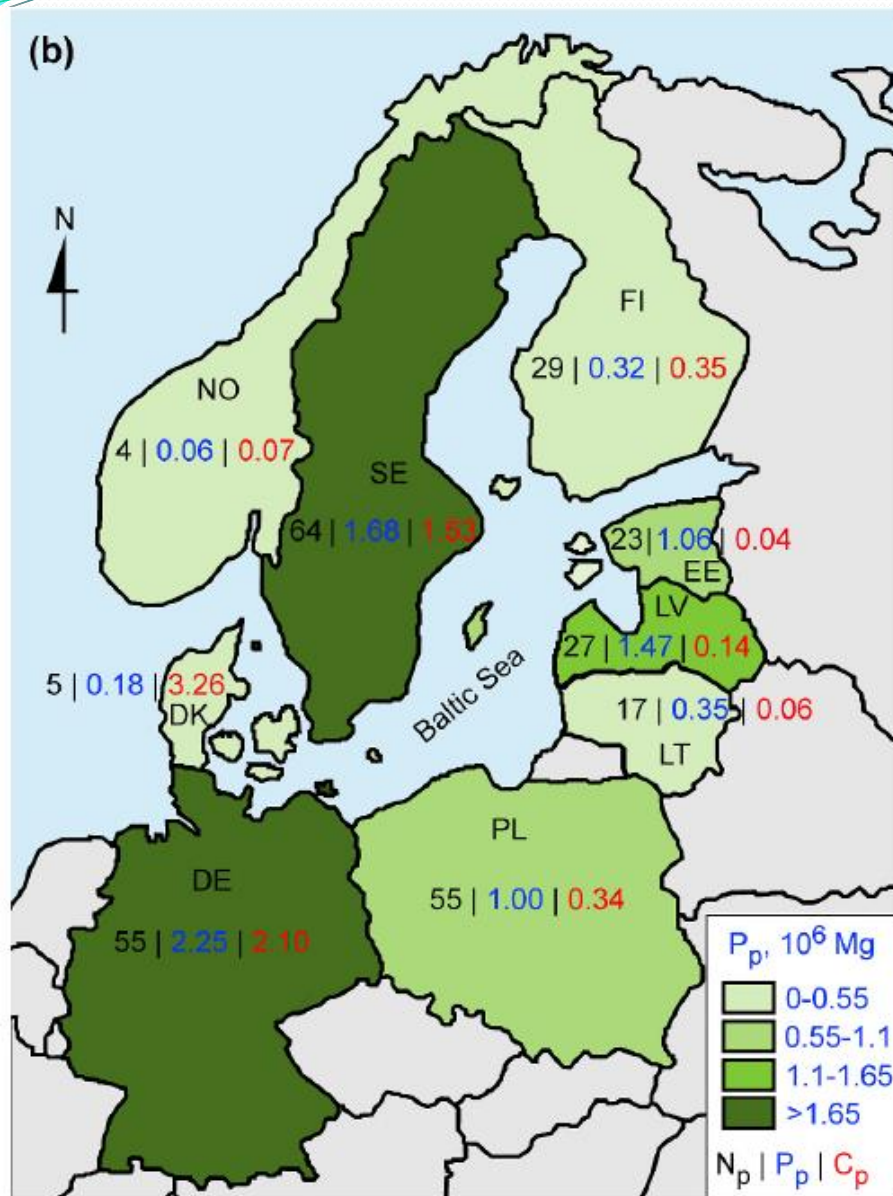
Share of different types of renewable energy sources in the gross inland consumption of total renewable energy sources in the BSR countries



Source: Stolarski et al. 2020, Renewable and Sustainable Energy Reviews 133 (2020) 110238

Use of biomass as shares of gross inland energy consumption in the BSR countries





Pellets market in the BSR countries

N_p – number of operating production pellets plants

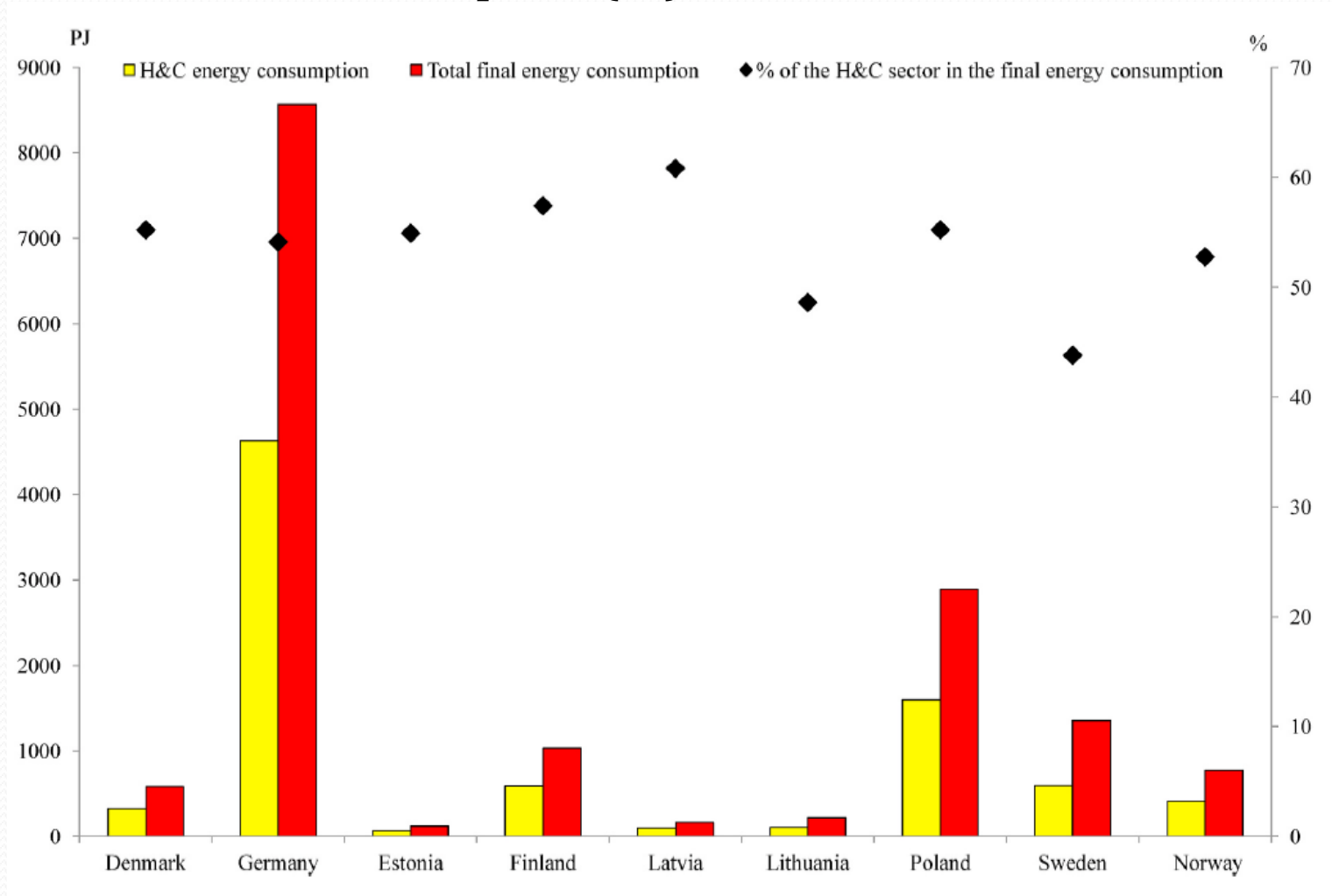
P_p – pellet production, million Mg

C_p – pellet consumption, million Mg



Photo: M.J. Stolarski

Heating and cooling (H&C) consumption compared with total final energy consumption (PJ) and the H&C sector in the final energy consumption (%) in BSR countries

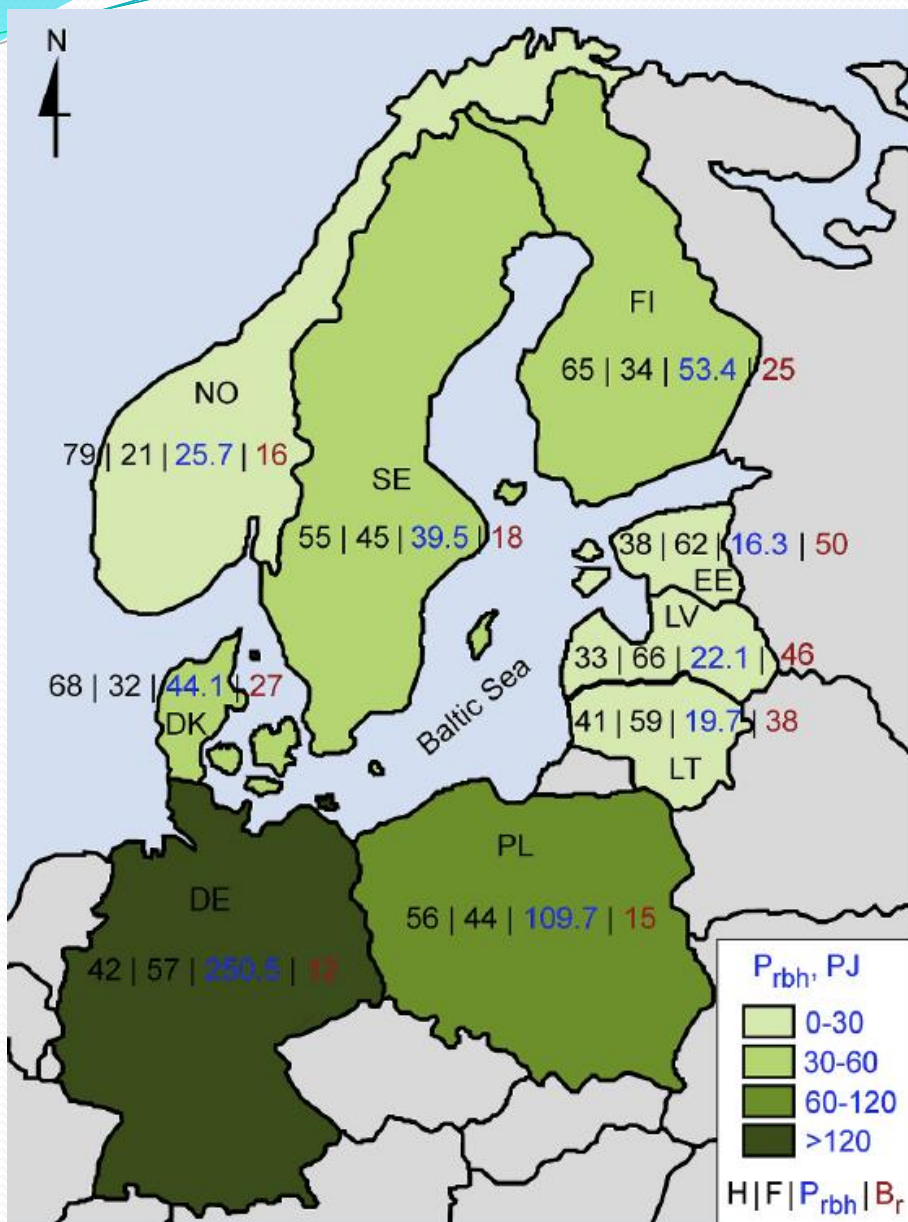


Residential bioheat production in the BSR countries

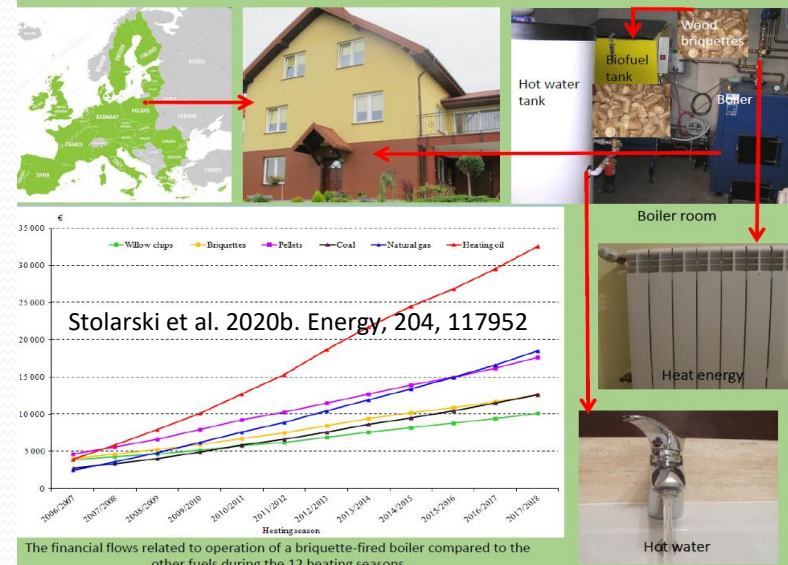
H|F – distribution of the population by dwelling type – houses/flats, %

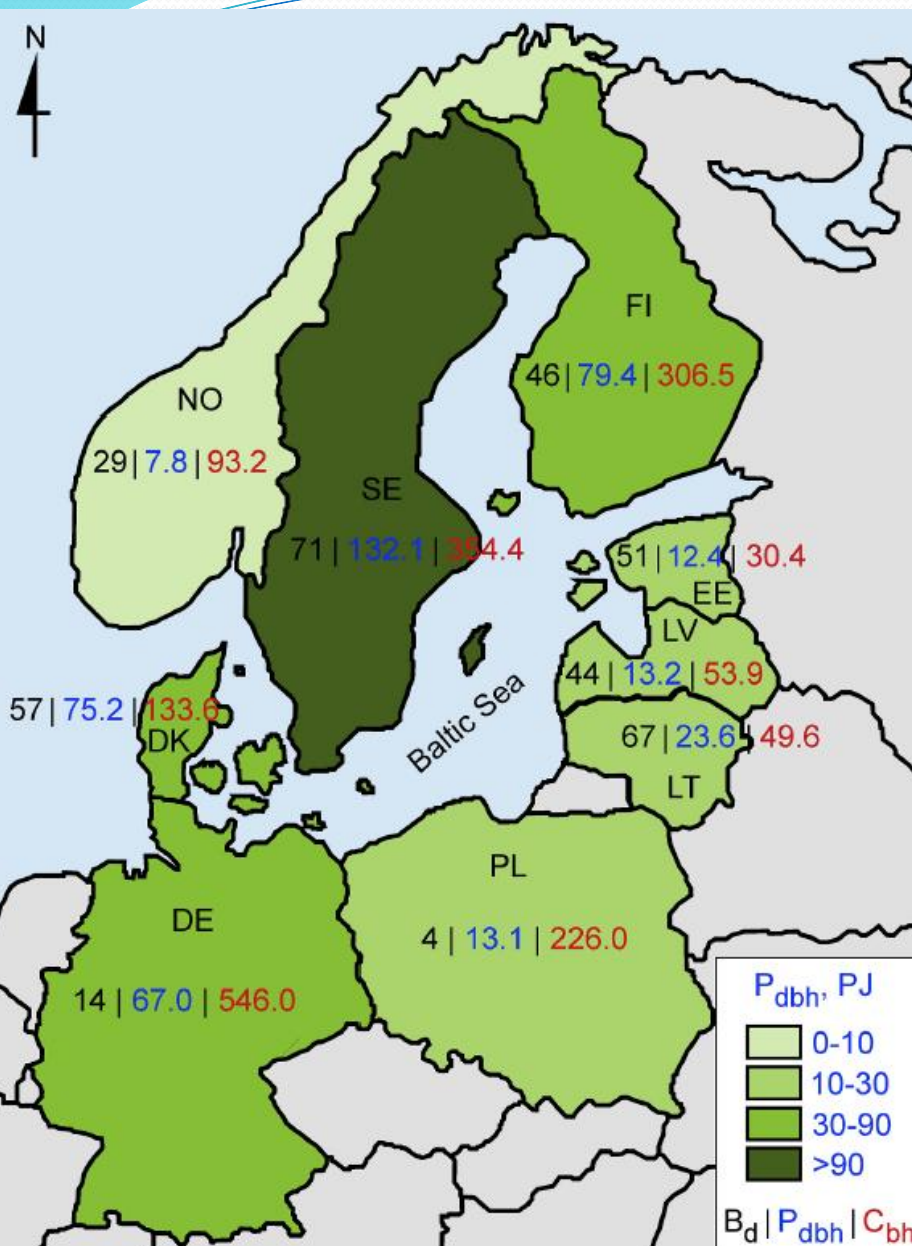
P_{rbh} – residential bioheat production, PJ

B_r – biomass in the structure of residential heat production, %



Is heating a detached house with solid biomass for 12 years cheaper than heating with fossil fuels?





Derived bioheat in the BSR countries

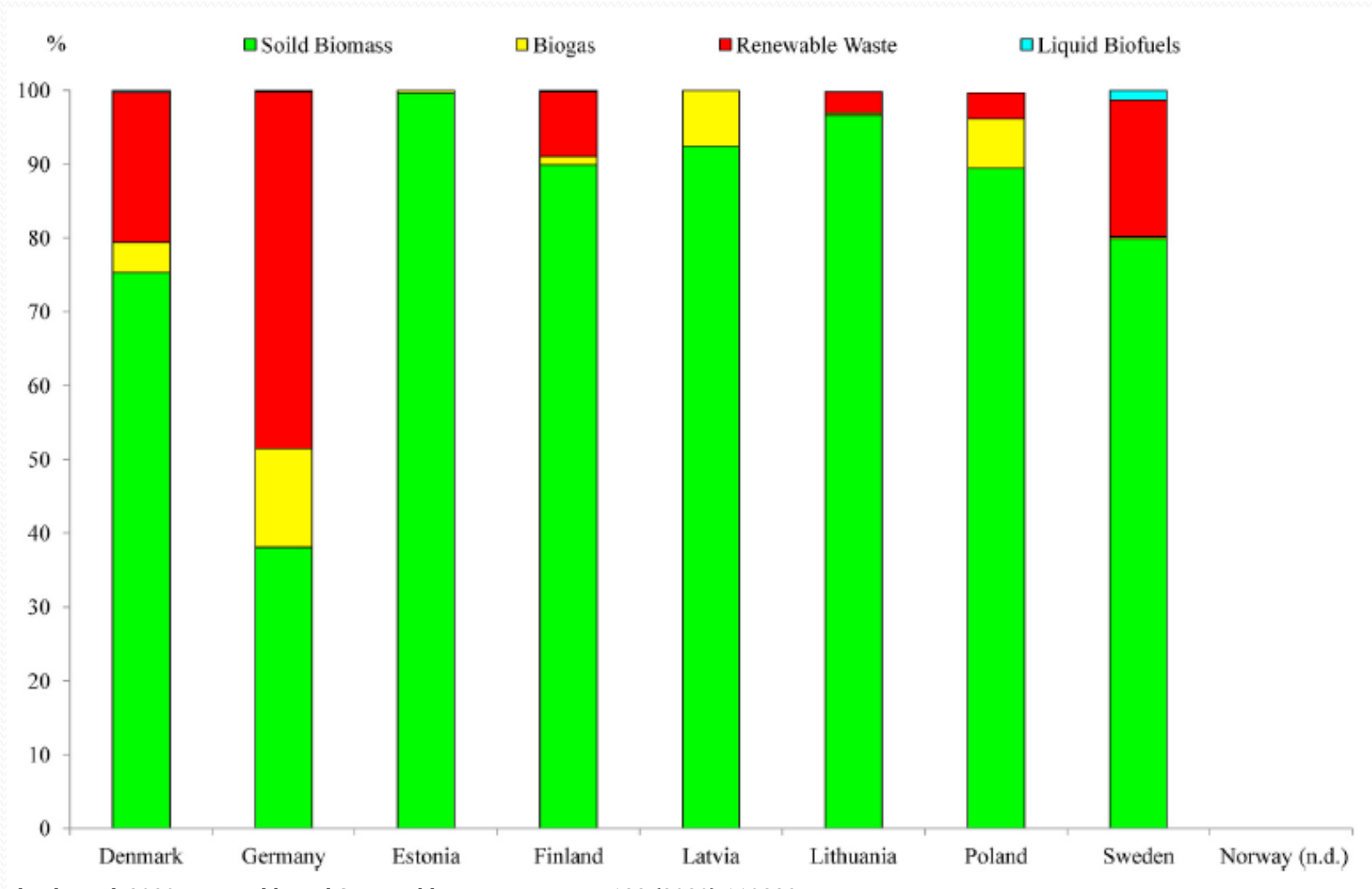
B_d – total biomass in the total derived heat production, %

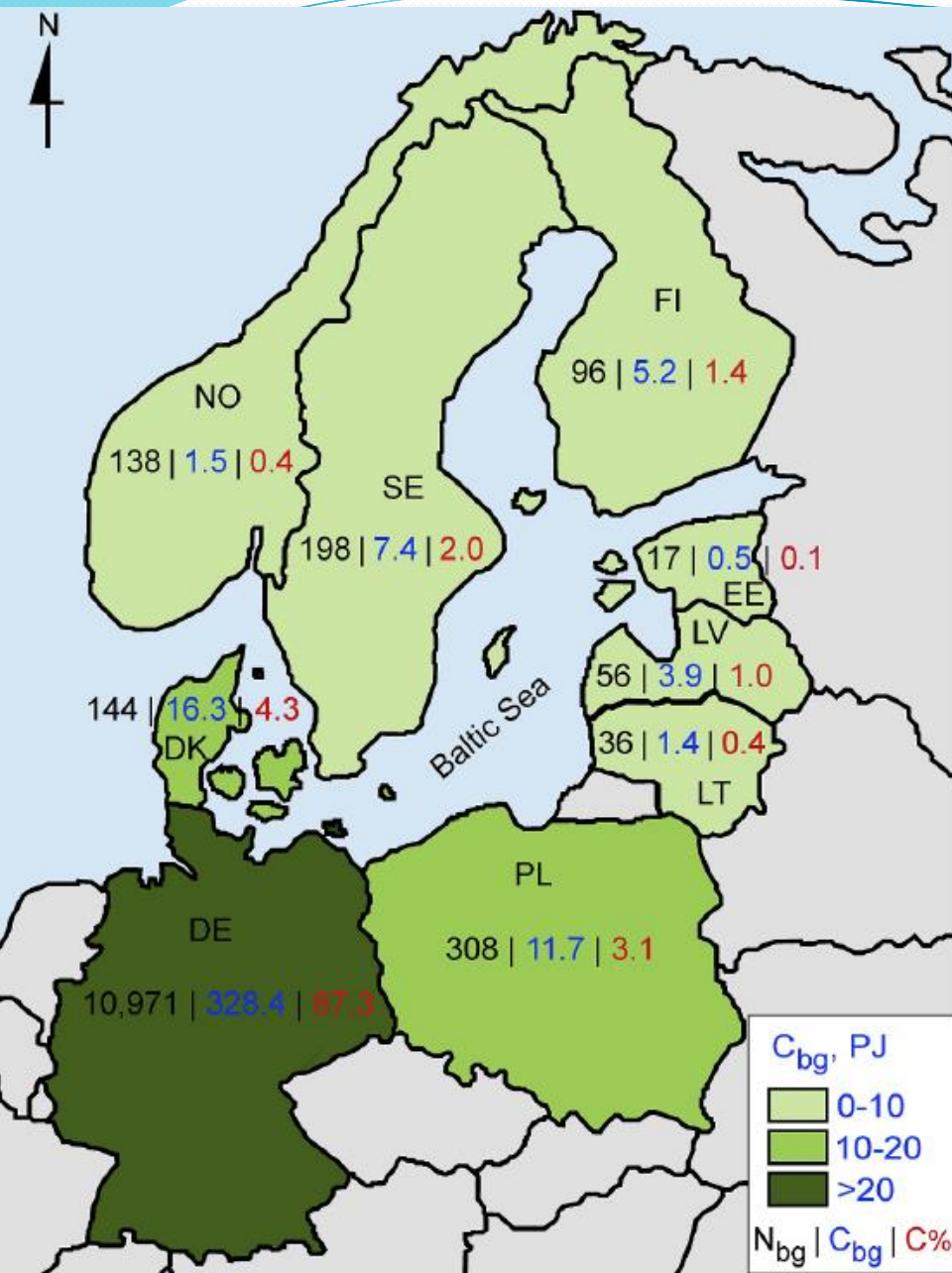
P_{dbh} – gross production of derived bioheat, PJ

C_{bh} – final consumption of bioheat, PJ



The share of solid biomass, biogas, renewable waste and liquid biofuels in gross production of derived bioheat in the BSR countries (n.d. - no data)





Biogas in the BSR countries

N_{bg} – number of biogas plants

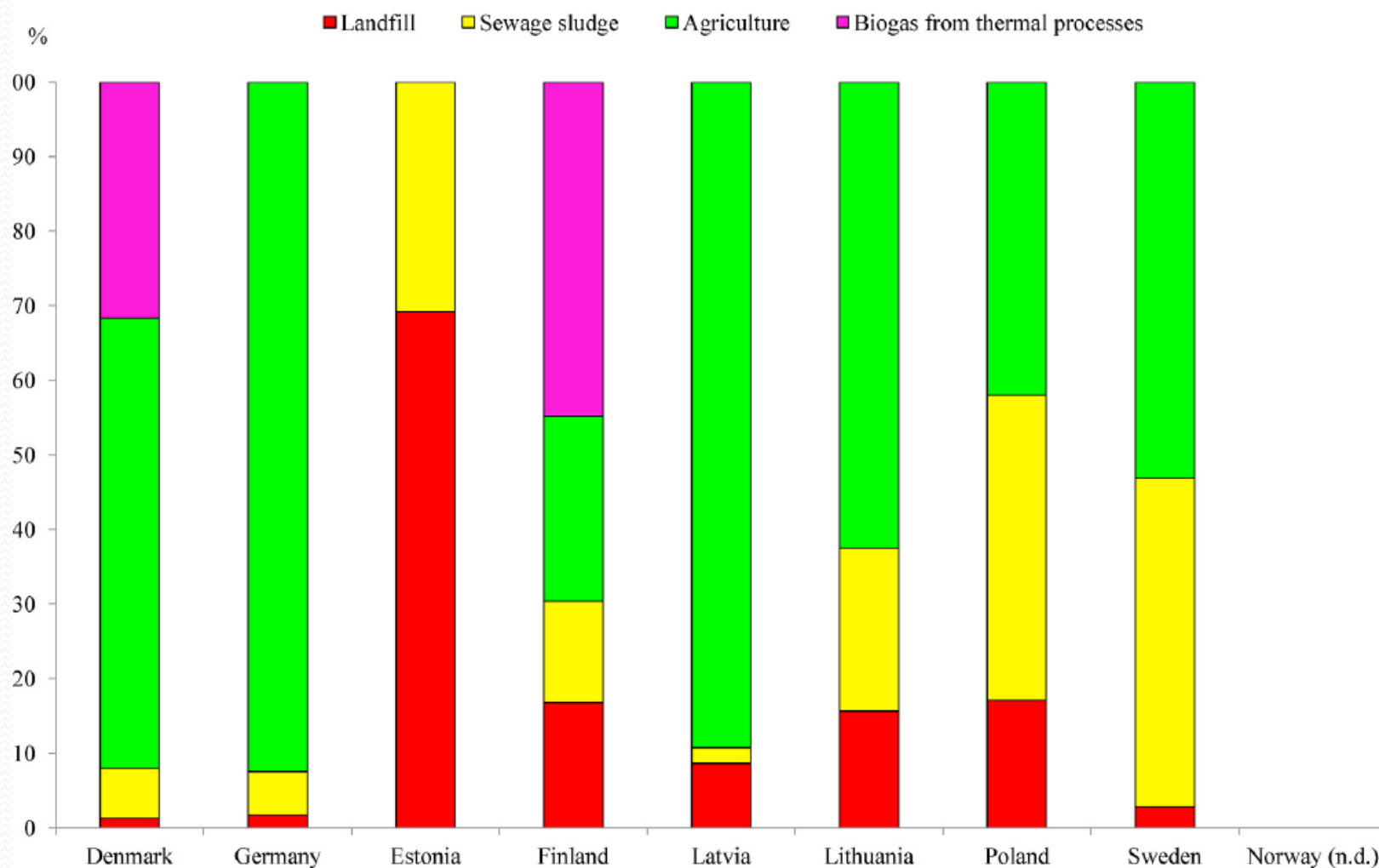
C_{bg} – gross inland consumption of biogas in PJ

$C\%$ – gross inland consumption of biogas in %

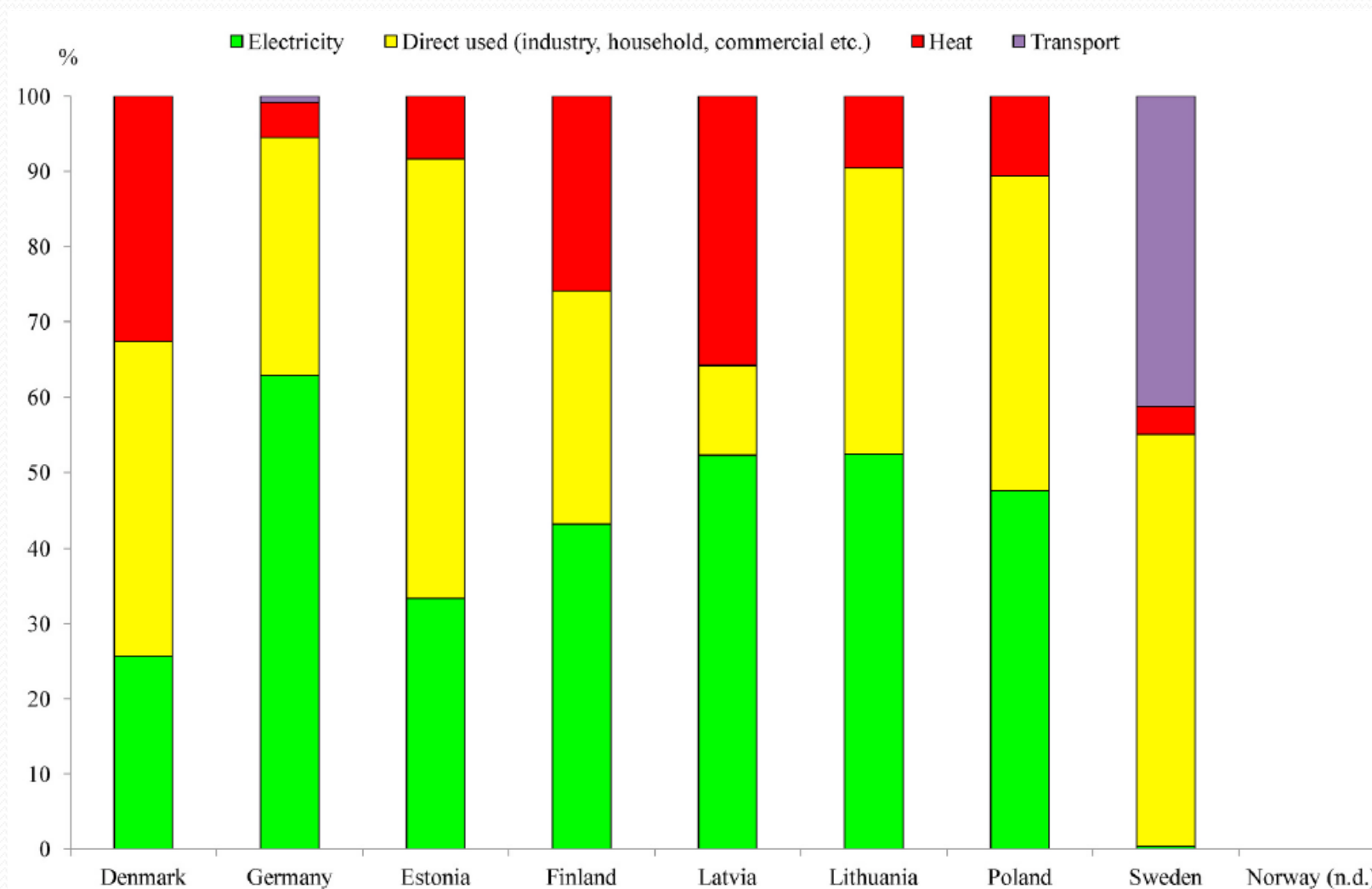


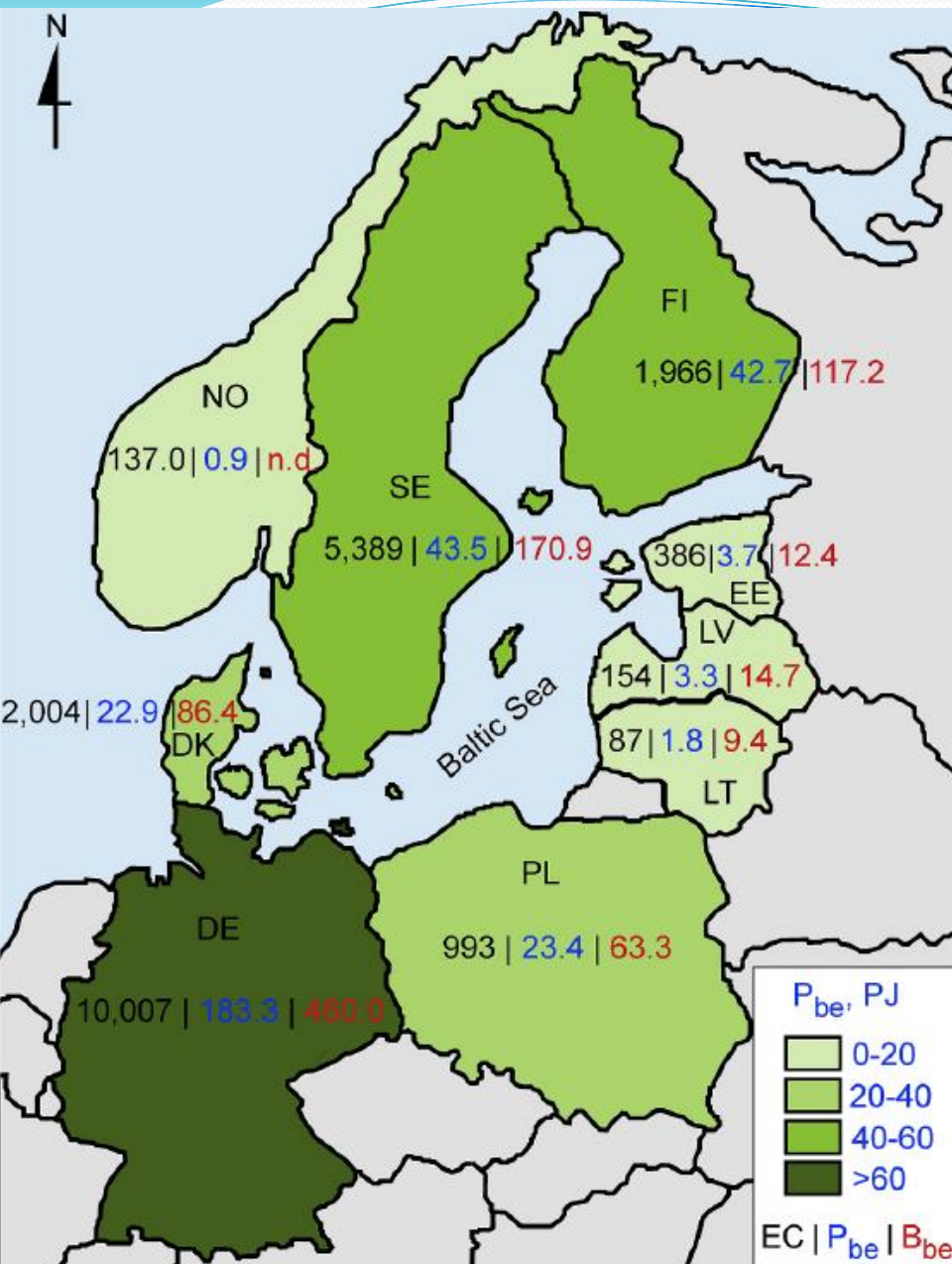
Photo: M.J. Stolarski

Primary energy production of biogas by biogas plant type in the BSR countries (n.d. - no data)



Gross final energy consumption from biogas by end-use in the BSR countries (n.d. - no data)





Bioelectricity in the BSR countries

EC – electrical capacity from biomass plants, MW

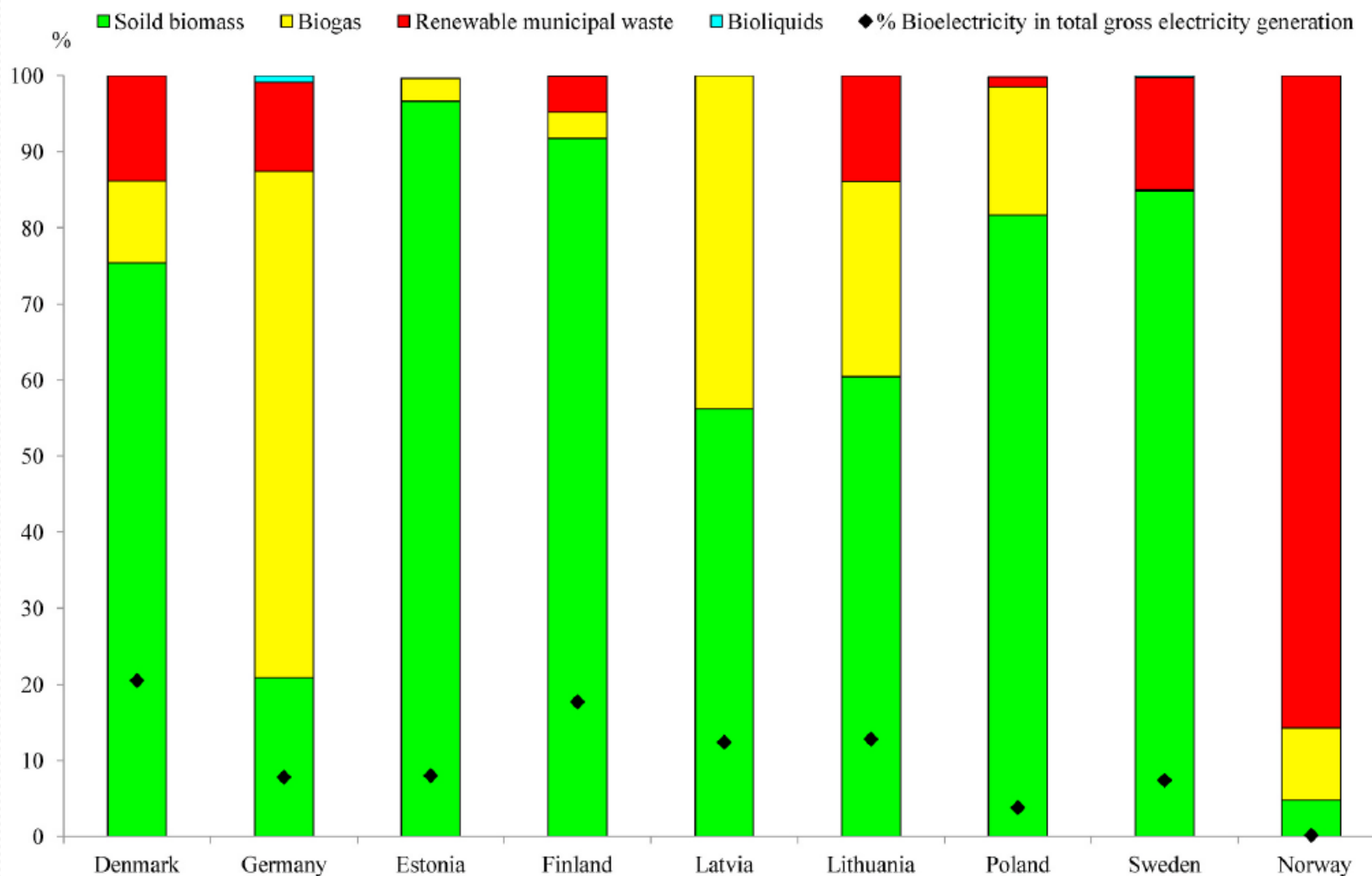
P_{be} – gross electricity generation from total biomass, PJ

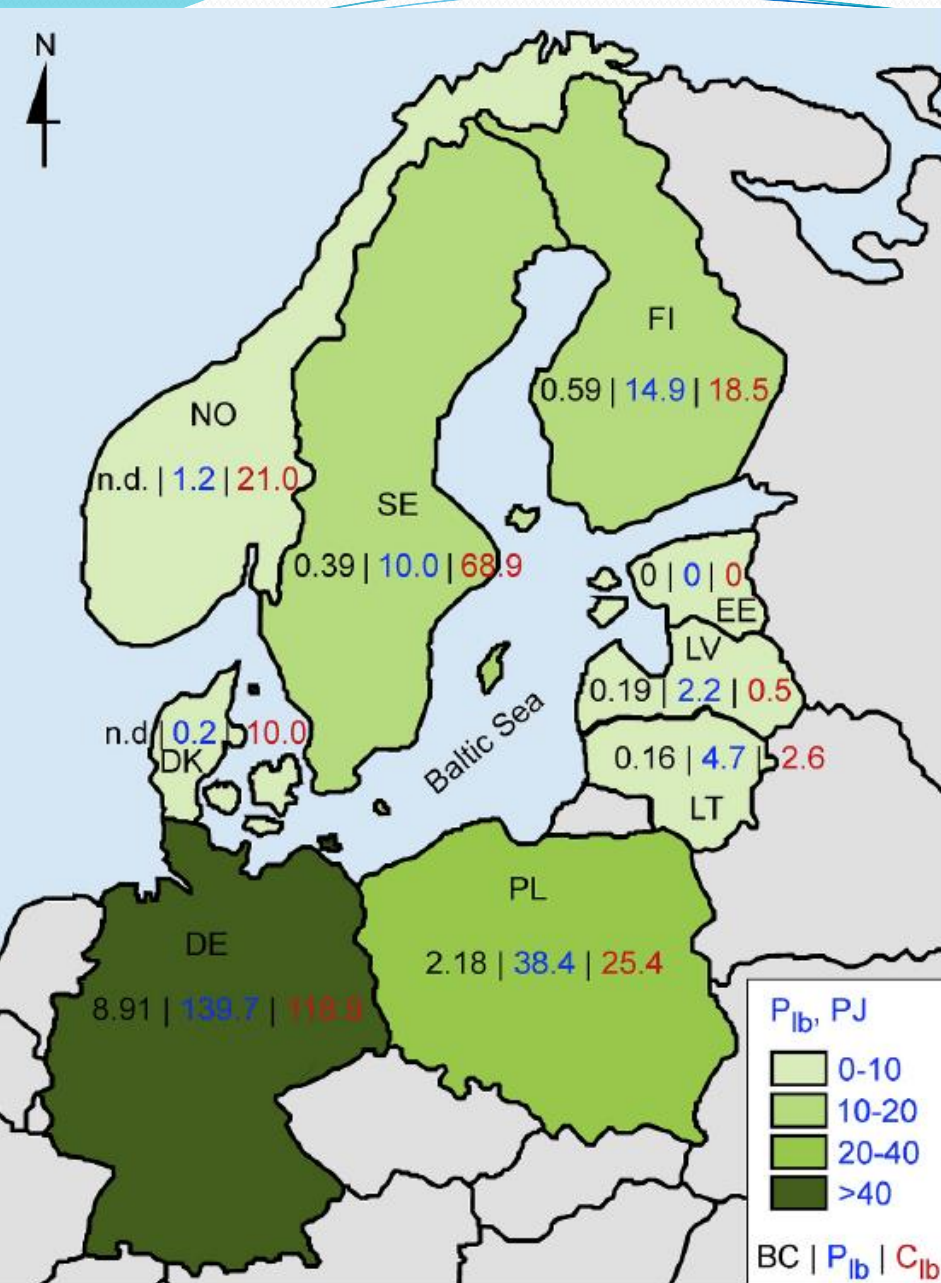
B_{be} – total biomass inputs for bioelectricity generation, PJ

n.d. - no data



The share of solid biomass, biogas, renewable municipal waste and liquid biofuels in gross electricity generation from biomass and the share of bioelectricity in total gross electricity generation in the BSR countries





Liquid biofuels in the BSR countries

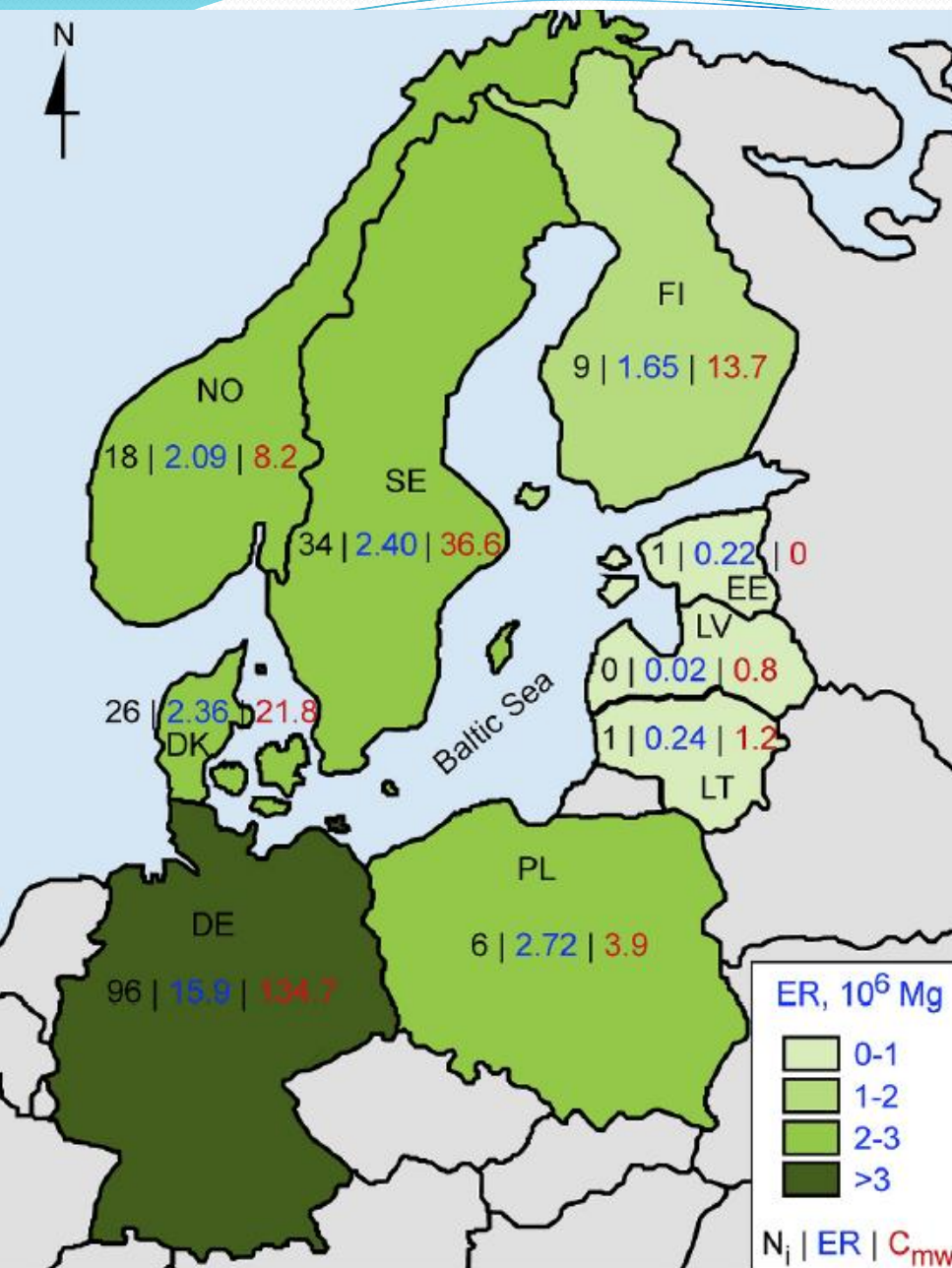
BC – biofuel
capacity, million Mg

P_{lb} – primary production of
liquid biofuels, PJ

C_{lb} – gross
consumption of liquid
biofuels for transport, PJ

n.d. - no data





Incineration plants and renewable municipal waste for energy recovery and gross consumption of renewable municipal in BSR countries

N_i – number of waste-to-energy plants

ER – waste thermally treated in waste-to-energy plants, million Mg

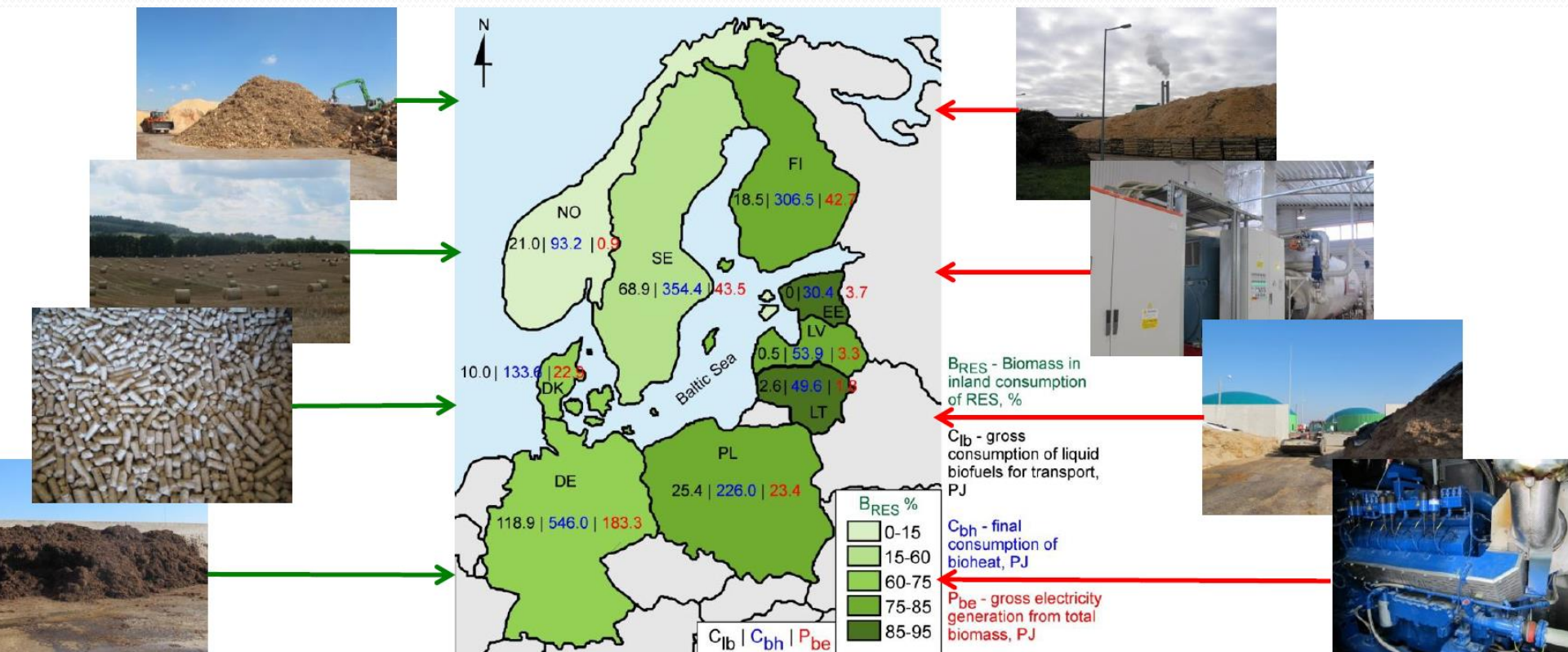
C_{mw} – gross consumption of municipal waste, PJ



CONCLUSIONS

- **BSR** countries were characterized by a high share of woodlands and agricultural land. They produce large amount of wood and agricultural biomass, particularly Germany and Poland.
- **BSR** countries had high share of pellets production among all the EU (55%).
- **The technical potential of straw** in the BSR amounted to 34% of the whole EU potential.
- **The area of perennial crops** amounted to 55% of the total area of these crops in the EU.
- **The potential of manure and slurry** amounted to 25% and 30% of the potential of the whole EU, respectively.
- **Denmark** uses by far the largest amounts of pellets for energy generation.
- **Germany** is the leader among the BSR countries in terms of the amount of bioenergy produced in each sector and it has by far the largest number of biogas plants and experience in this sector.
- **Estonia** has the largest share of biomass in the total of residential heat production.
- **Latvia and Finland** have the highest share use of biomass as shares of gross inland energy consumption.
- **Sweden and Lithuania** have the highest rates of total biomass in the total derived heat production.
- **Poland** ranks second in terms of the number of biogas plants, biofuel installed capacity and primary production and the number of pellet plants.
- **Norway** has the largest share of renewable waste in gross electricity generation from biomass.

CONCLUSIONS





References

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<https://doi.org/10.1016/j.energy.2020.117952>.



THANK YOU FOR ATTENTION

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