

The evolution of the residual mix as key tool for avoiding double counting

RE-DISS II Final Conference, Belgium

Bruges, 23.9.2015

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WP 5 Environmental indicators

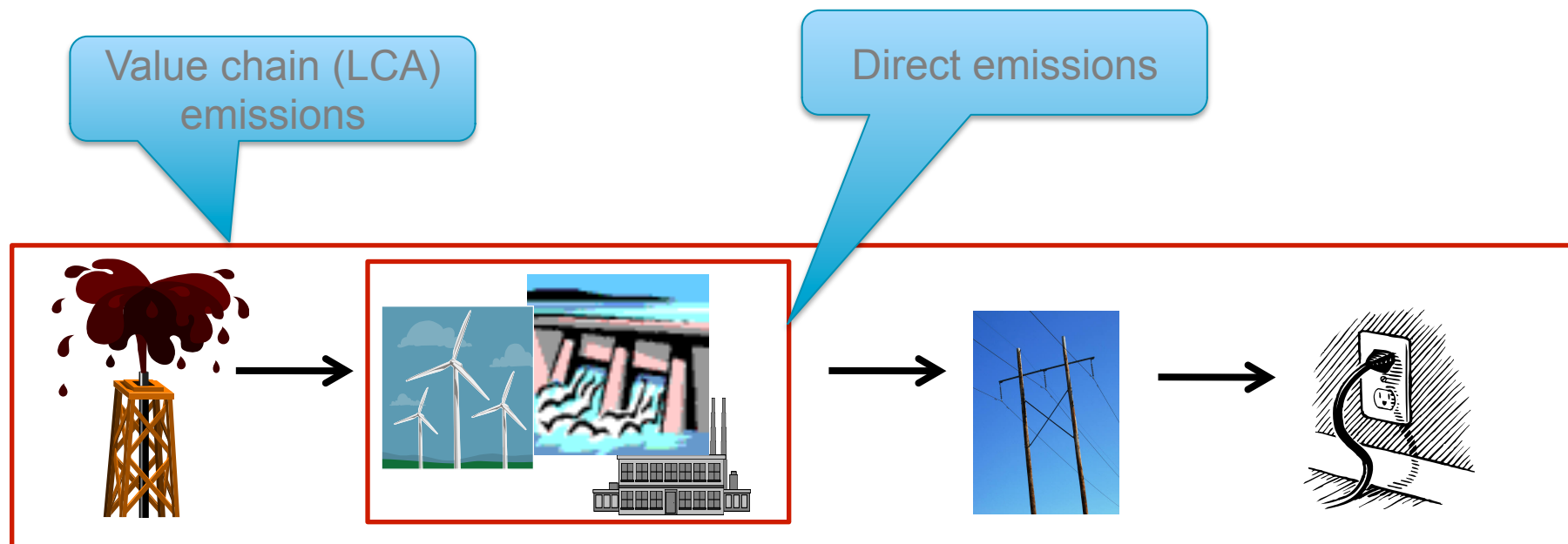
Hanne Lerche Raadal
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Different value chain approaches



- The Directive does not provide any specifications of how the indicators should be calculated or which elements of the product chain have to be taken into account.

What's new?

- 3 additional indicators for GHG emissions

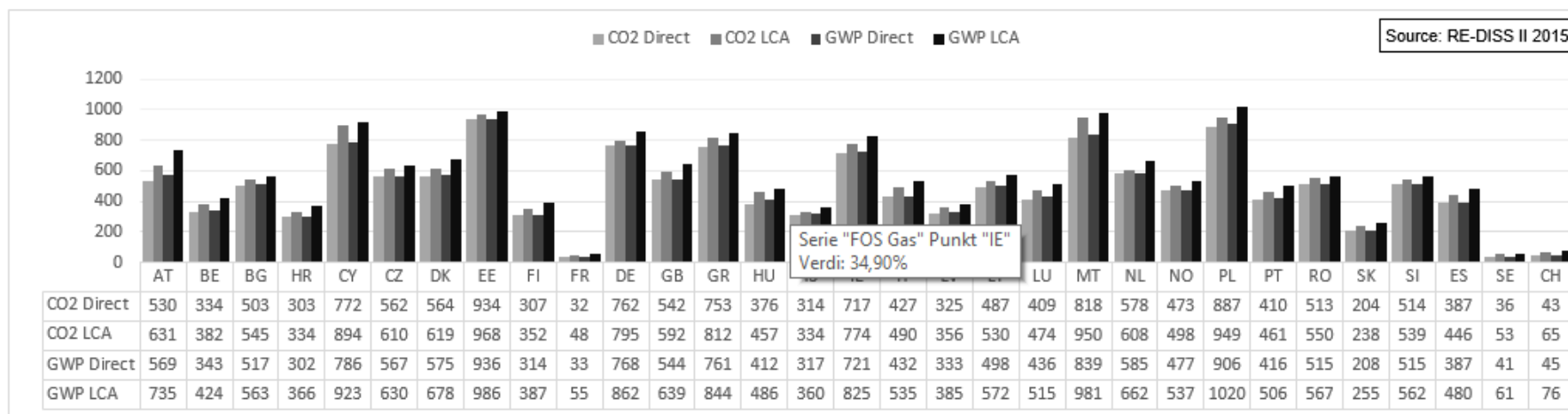
Environmental indicator		Unit	Direct emissions	Emissions based on LCA (life cycle assessment) methodology
GHG emissions	Single substance	g CO ₂ per kWh	X	X
	GWP*	g CO ₂ -equiv. per kWh	X	X
High-level Radioactive waste (RW)		mg RW per kWh	X	

Greenhouse gas (GHG) emissions can be illustrated by the single greenhouse gas CO₂ and/or by several greenhouse gases (e.g. CO₂, CH₄, N₂O, etc.) being converted into CO₂-equivalents according to their Global Warming Potential.

*GWP: Global Warming Potential

GHG emissions of Residual Mixes (2014)

Figure 4: CO₂ content in Final Residual Mixes 2014 [gCO₂(e)/kWh]



CO₂ Direct = Direct onsite CO₂ emissions resulting from generation of 1 kWh.

CO₂ LCA = Life Cycle Assessment CO₂ emissions resulting from generation of 1 kWh.

GWP Direct = Direct onsite Global Warming Potential emissions resulting from generation of 1 kWh.

GWP LCA = Life Cycle Assessment Global Warming Potential emissions resulting from generation of 1 kWh.

Anyone using the new indicators?

Direct CO₂-emissions and nuclear waste per kWh

Environmental indicator		Energy source/technology		AT	BE	BG	HR	CZ	DK	FI	FR
mg/kWh	Direct	Nuclear		n/a	2,7	3,5	n/a	3,5	n/a	3,0	2,7
CO2 (kg/kWh)		Fossil	Hard Coal	0,8380	0,9480	1,0570	0,9490	1,1350	0,8140	0,8140	0,9490
			Lignite (or brown coal)			1,1000	1,2600	1,1300			
			Natural Gas	0,4751	0,4416	0,6092	0,5497	0,4992	0,3430	0,4172	0,3980
			Oil	0,7040	0,7900	0,7930	0,8270	0,8509	0,7120	0,4480	0,6500
			Unspecified (fossil)	0,4861	0,4609	1,0933	0,5720	1,1340		0,4329	

...and 23 more countries.

Data for all EU 28 + CH, NO, IS will be provided on the RE-DISS website

- Sources CO₂: Treyer and Bauer (2013), Dong Energy A/S/Energi.dk/ Vattenfall (2010), Fritsche and Rausch (2009), Bauer (2008), GEMIS database (2015)
- Sources nuclear waste: As detailed data per reactor is not available, the data is based on estimates for five different types of nuclear reactors used in Europe (PWR, BWR, VVER, Magnox/AGR, CANDU).

LCA-based CO₂/CO₂-eqv. and direct CO₂-eqv. per kWh

Weighted average data based on overall annual production in all countries

Energy source/technology		Weighted average		
		LCA	Direct	LCA
		CO2 (kg/kWh)	GWP (kg CO2-eqv/kWh)	
Renewable	Solar	0,0624		0,0708
	Wind	0,0182		0,0200
	Hydro & Marine	0,0053	0,0002	0,0058
	Geothermal	0,0549		0,0590
	Biomass & Biogas	0,1181	0,0460	0,1762
	Unspecified (renewable)	0,0299	0,0206	0,0535
Fossil	Hard Coal	1,0382	0,9660	1,1626
	Lignite (or brown coal)	1,1986	1,1641	1,2192
	Natural Gas	0,5258	0,4614	0,5658
	Oil	0,8869	0,7844	0,9142
	Unspecified (fossil)	0,8060	0,7785	0,8981

Data will be provided on the RE-DISS website

Sources: The Ecoinvent database v3.01 and electricity generation data 2013 (ENTSO-E) 7

Short summary data set and sources (1)

- GHG emissions per kWh for the different technologies and countries for all the 4 perspectives for GHG emissions
 - Direct CO₂ emissions provide per technology and countries
 - LCA-based CO₂/CO₂-eqv. and direct CO₂-eqv provided as weighted average data per technology
- Radioactive waste
 - High-level radioactive waste for the different technologies and countries
- The data sets are not subject to large annual changes
 - The given data can be used for some years - does not need to be updated on an annual basis.

Thank you

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WP7 RE-DISS Residual Mix

The evolution of the Residual Mix as a Key Tool for Avoiding Double Counting

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RE-DISS II Final Conference, Belgium

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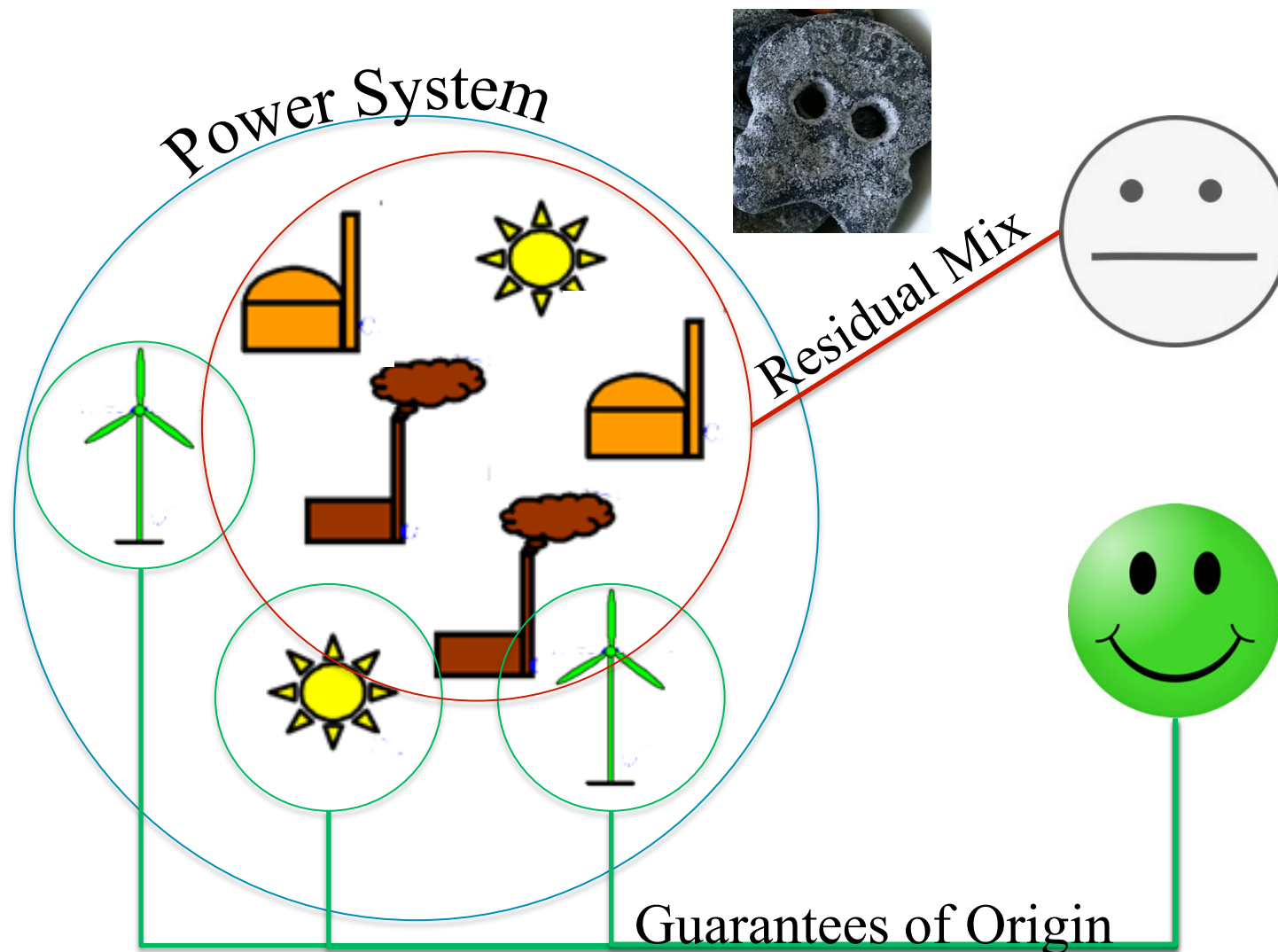


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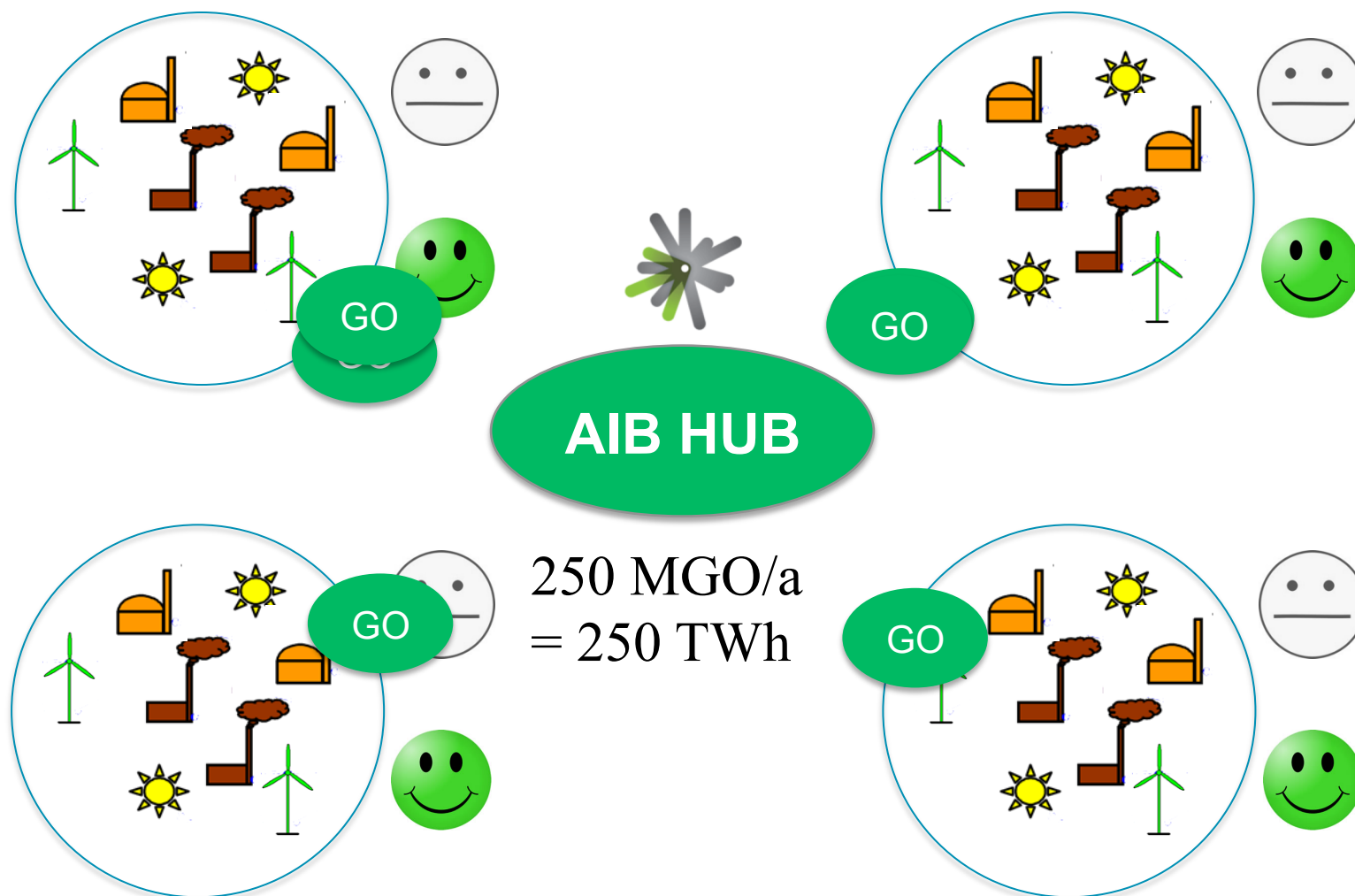




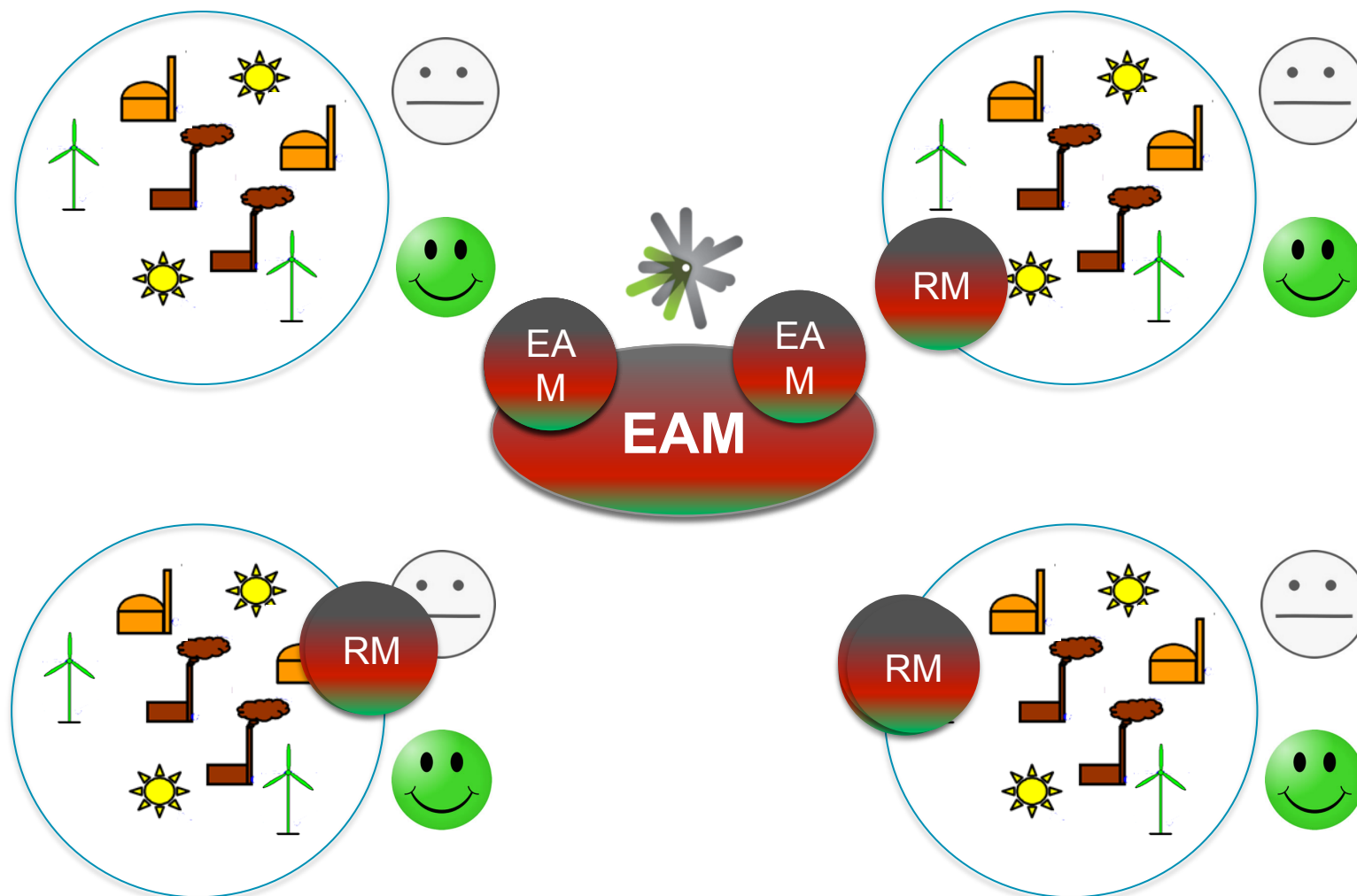
Residual Mix = Bad Candy



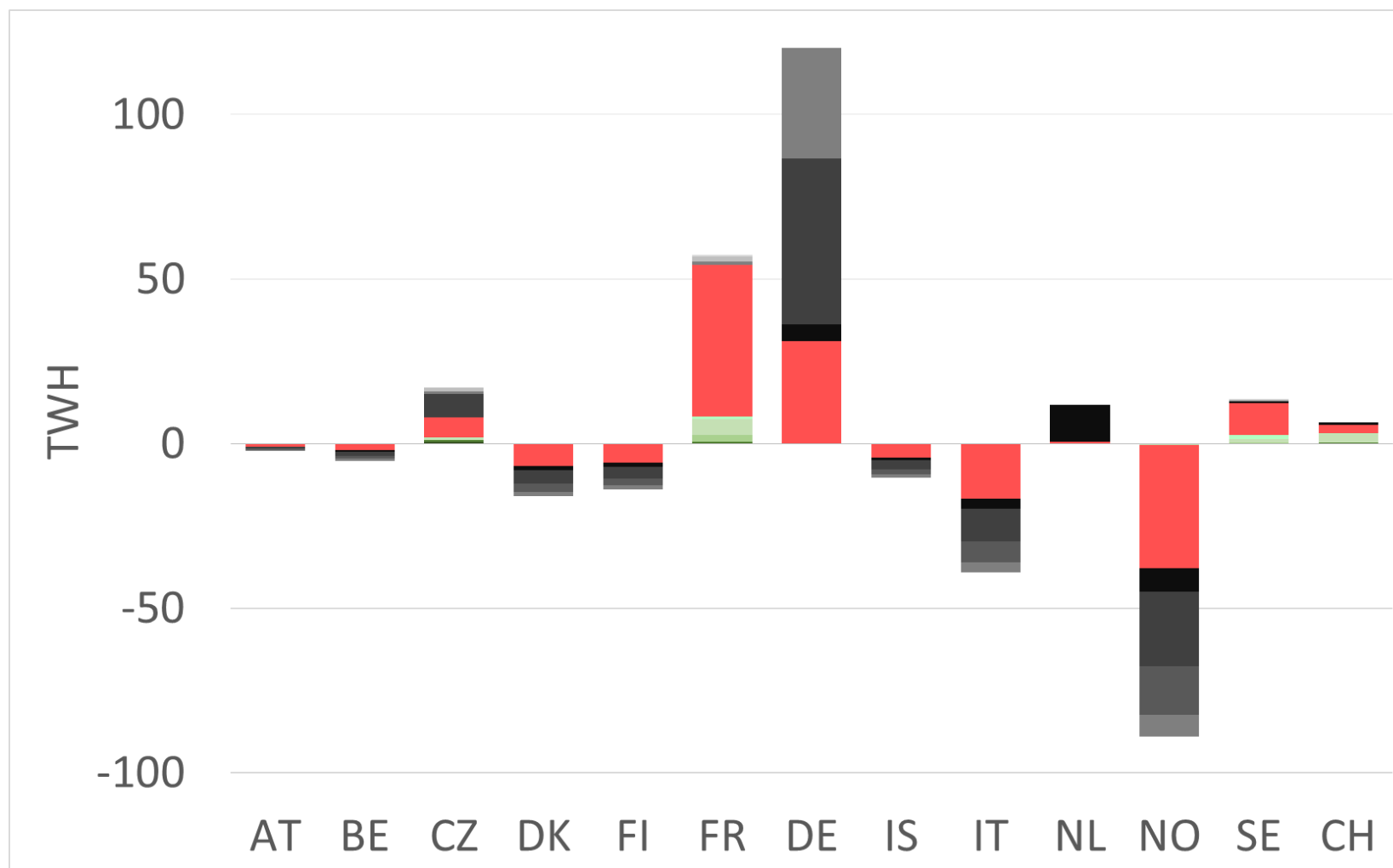
Renewables are transferred accross Europe



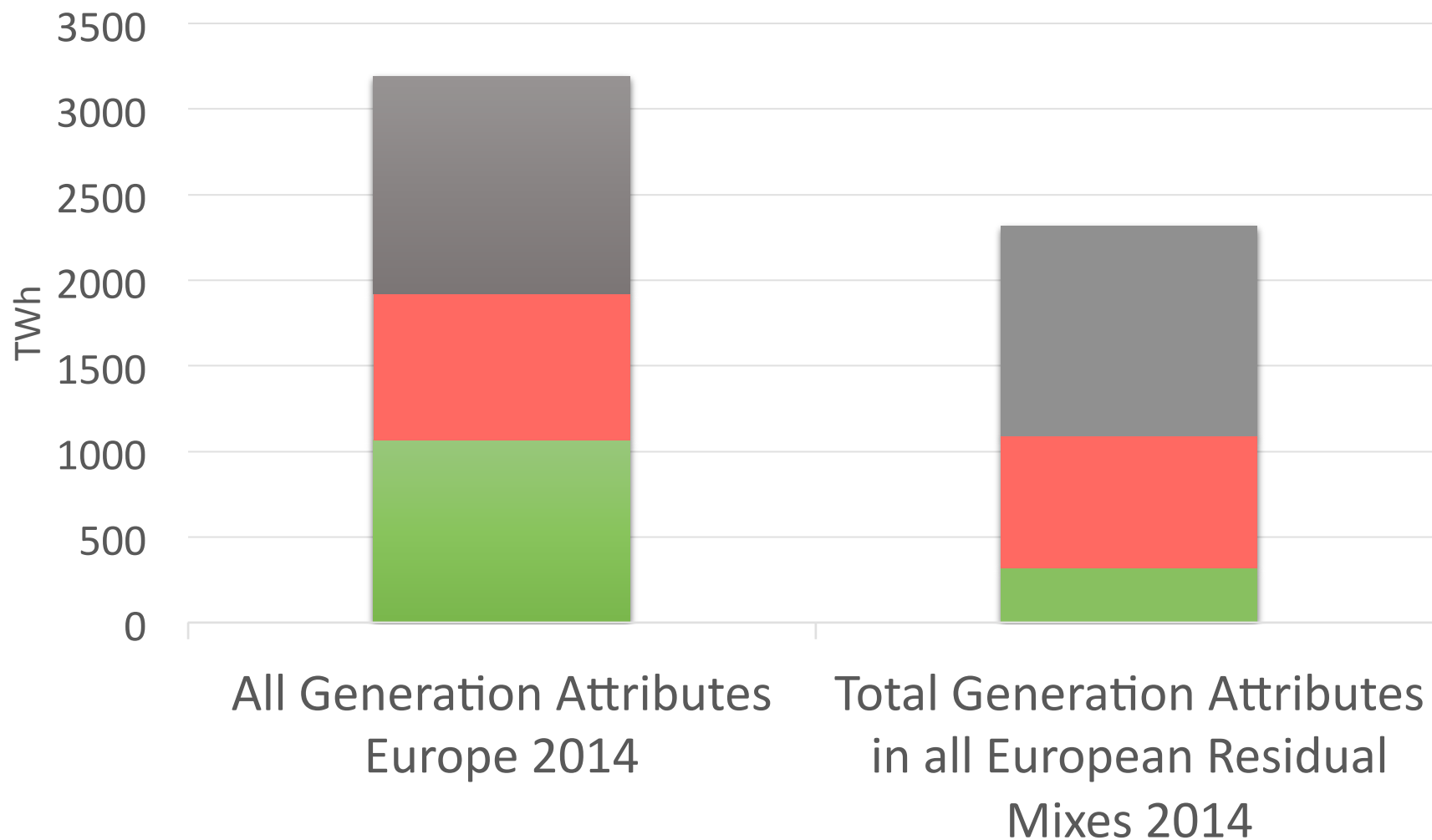
The European Attribute Mix determines what replaces an exported GO



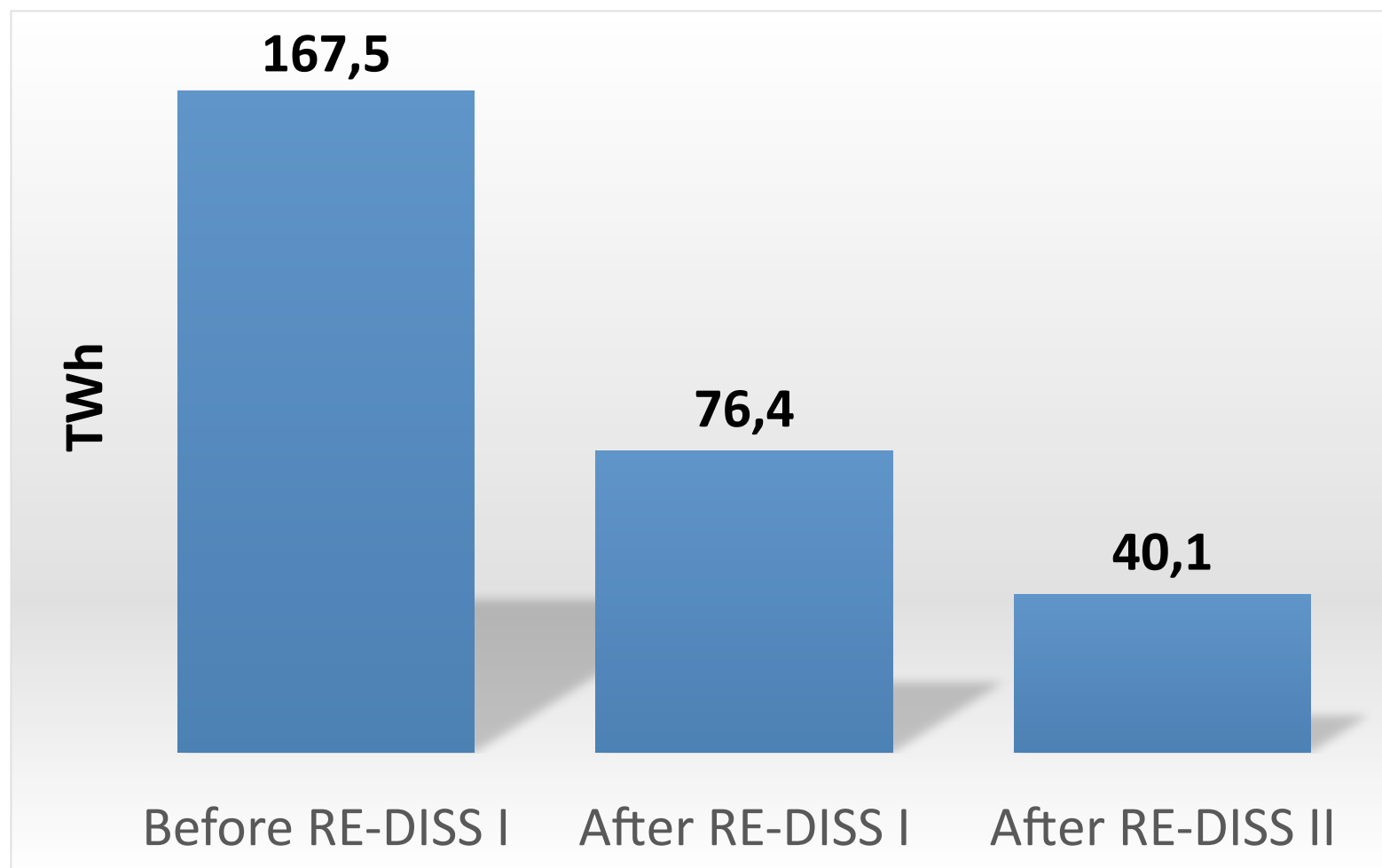
Interaction with the EAM 2014



Residual Mix Prevents 700 TWh of Double Counting!



Total double counting of renewables with RM practices Before and After RE-DISS (2014 data)



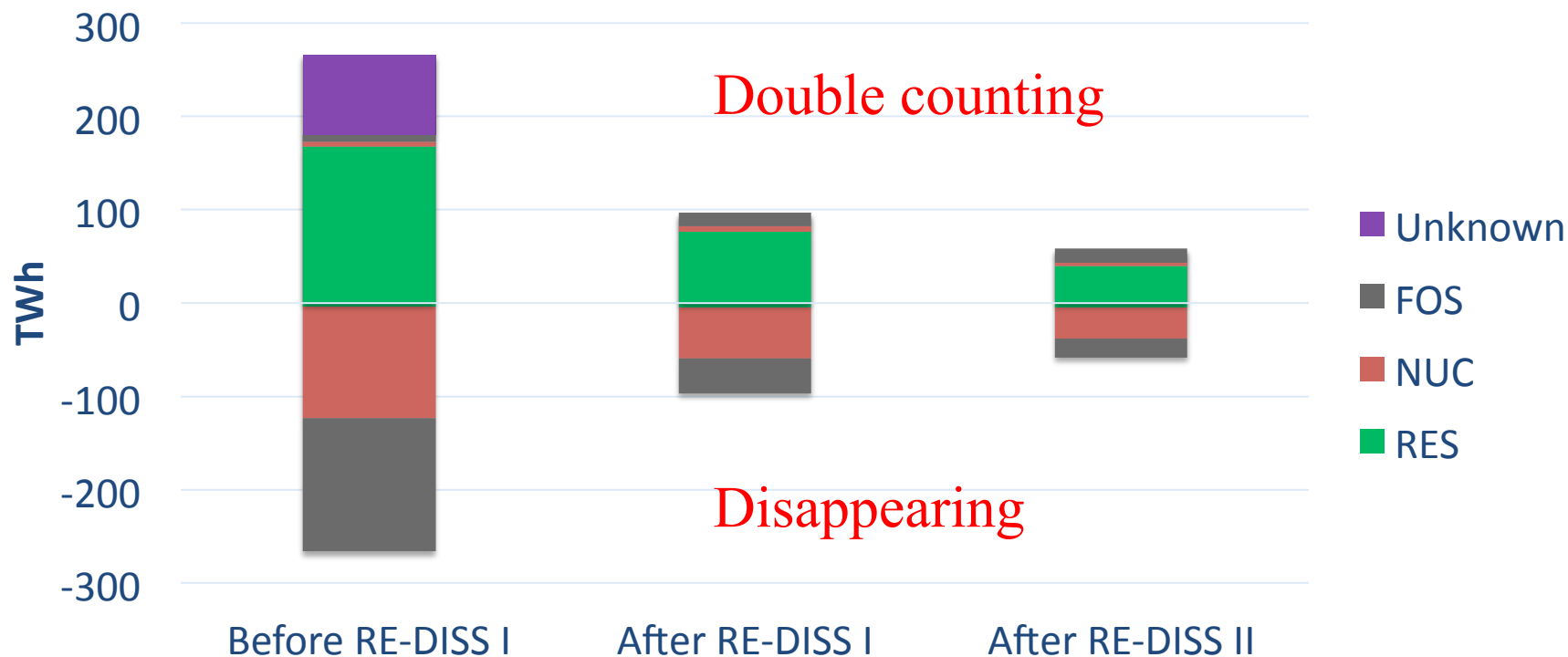
How was the analysis made?

- The implicit disclosure (RM) policies of 31 countries were replicated in three scenarios using 2014 RMC data:
 - Before RE-DISS I, After RE-DISS I and After RE-DISS II
 - Evaluated against calculation according to RE-DISS BPR
- The effect of major errors on total disclosure was studied:
 - Application of uncorrected generation statistics
 - Use of non-transparent (contract-based) tracking mechanisms
 - No harmonization → EAM not used for attribute deficits
 - As well as overlapping regions and calculation methodology problems
- Analysis does not reflect:
 - Errors at supplier level, Errors in explicit tracking

Basedata for the analysis

Country	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Description
France (1)	X	X		X		No residual mix. Mix of own production, contracts and ENTSO-e mix used for
France (2)	X	X		X		No improvements
France (3)	X	X				Estimated 70 % of untracked consumption now disclosed with RM. Contract based tracking still resides. Green offers can only be disclosed through Gos, but not all green in the supplier mix.
Germany (1)	X	X				Residual mix only corrected by German support RES-E volumes, but not for other explicit tracking. ENTSO-e mix for Germany minus German supported RES-E volumes as default value for disclosure. No clear regulation on eligible tracking instruments, therefore CBT, GOs, RECS and labels were used for explicit disclosure.
Germany (2)	(X)	(X)				National production mix, excluding all renewables, used for implicit disclosure. CBT only applicable for NUC/FOS
Germany (3)	(X)	(X)				Expired GOs added to implicit disclosure

Total Improvements

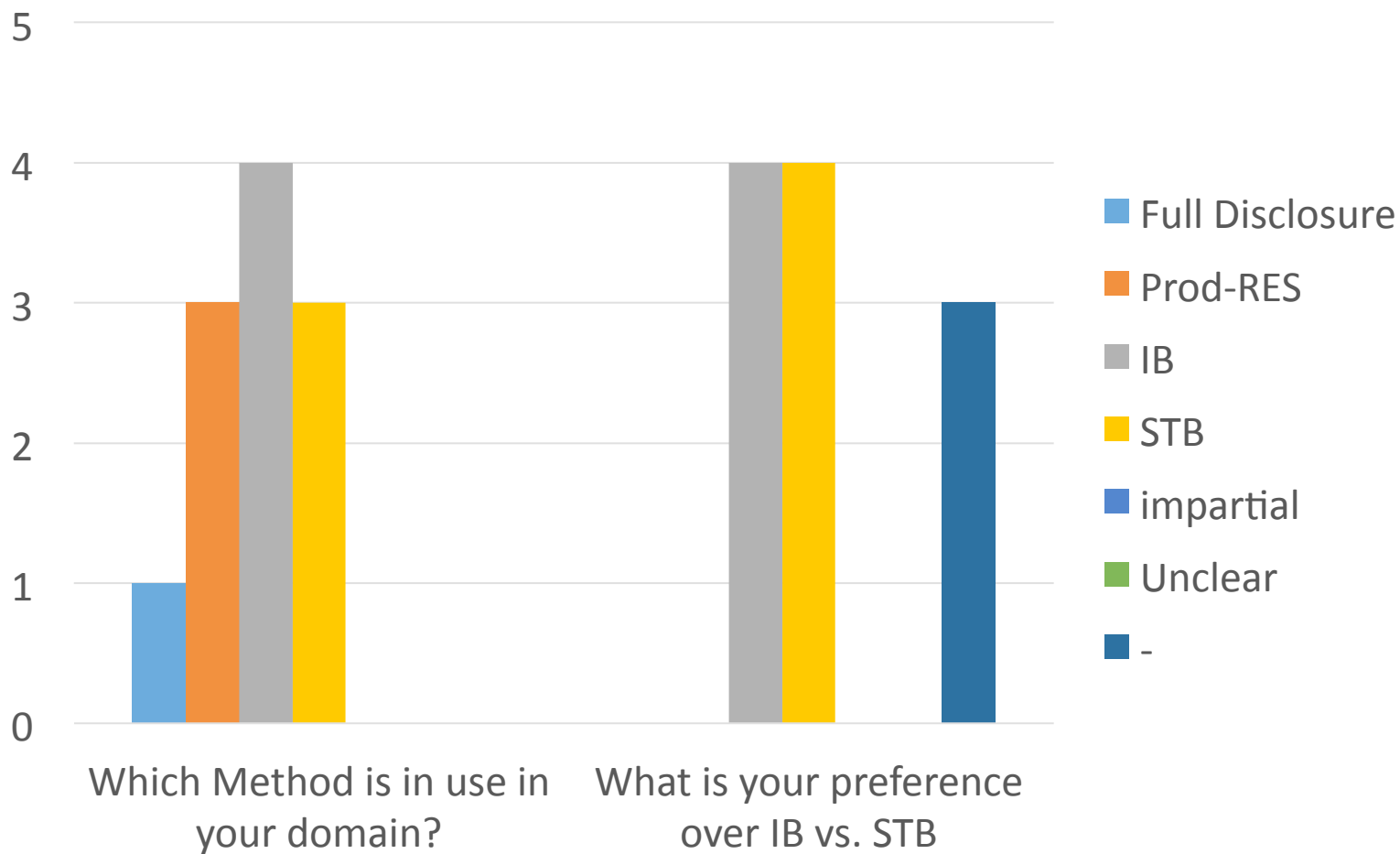


- **Unknown**: No unknown origin disclosed after RE-DISS I
- **RES**: Double counting down by 130TWh (36 in RE-DISS 2)
- **NUC**: Disappearing down by 90 TWh (22) \approx 260 Tons RW
- **FOS**: Disappearing down by 120 TWh (17) \approx 72 Megatons CO₂
- **Total**: Disclosure error down by 210 TWh (38)

Methodology Outlook

- **Issuance-Based Method**
 - **Deduct issuing**
- **Shifted Transaction-Based Method**
 - **Deduct cancellations and net export**
- Accurate, logical
 - Especially if production= disclosure year
- Robust without special measures
- Needs special measures, against:
 - Expanding/shrinking EAM
 - Late issuing
- Downsides
 - Inaccuracy of prod.year, negative RES, international movements

How is residual mix calculated in your domain?



In need of Robust and Simple Legacy Methodology

- Before RE-DISS: Central RM calculation for all countries
- During RE-DISS: RE-DISS in provides EAM for all and RM for some
- Current situation: One size doesn't fit all! (discl. DL; prod. and discl. year...)
- Legacy:
 - STB is always solid against double counting without extra measures or data
 - may be solvable at country level, but not yet centrally
 - Both IB and STB supported → equal in long-run
 - CBs should assess the options in their regulative setting
- Central RM calculation for all countries after further harmonization?

Conclusions

- Without an implicit disclosure regime, explicit electricity tracking (GOs) is double counted!
 - Implement residual mix
 - Make cancelled GOs sole way to sell RES (/electricity from a known source)
- Measures taken during RE-DISS have reduced double counting by 130 TWh
 - Difference to 2012 analysis due to more tracking and countries
- European Attribute Mix will continue to be counted using a shifted transaction-based methodology
 - Issuance-based methodology continues to be supported and fits well in countries where production and disclosure year of GOs are to large extent the same.

Thank You for Your Attention!

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