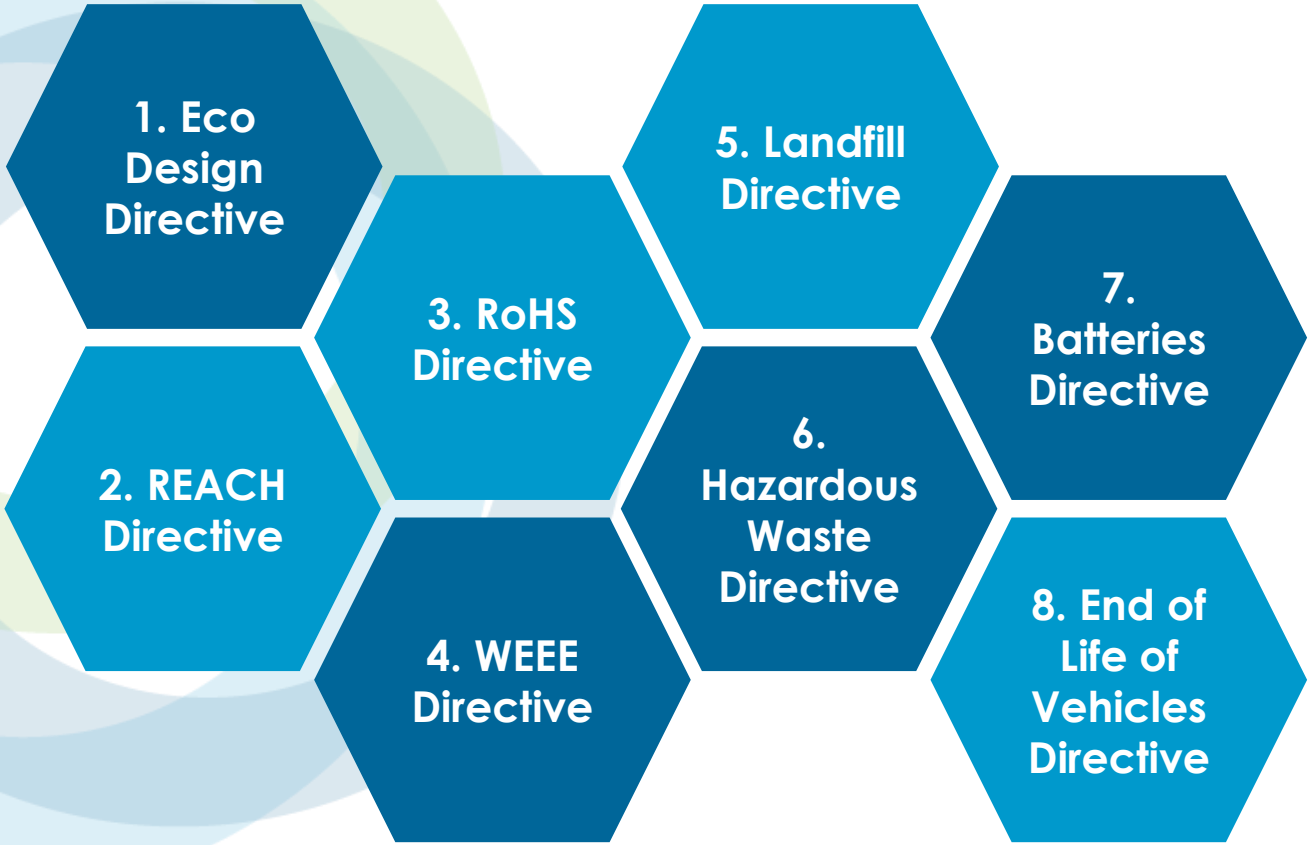
HyTechCycling

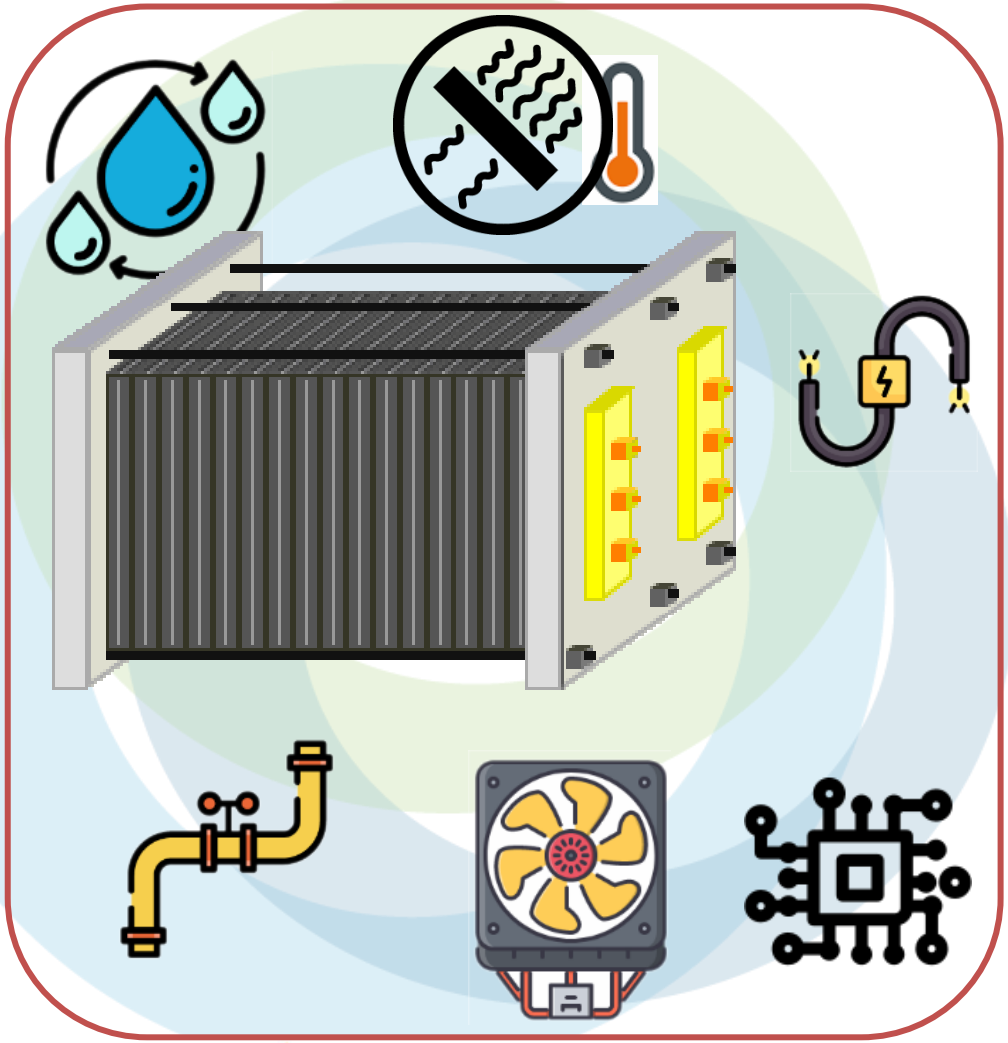
RCS regarding recycling and dismantling of FCH technologies

Regulations that applies to FCH technologies

There is no proper legislation around the FCH technologies. Which directives could affect FCH technologies?



Separation



Stack components

BoP components

Legislation reference to life cycle of a FCH system

Life cycle of FCH	DIRECTIVES	FCH stack	BoP components	power conditioning	Batteries	Cabinet	FCH product	FCEV	CHP
Design	Eco Design Directive	X	X				X	X	X
Material selection	REACH Regulation	X	X				X		
	RoHS Directive			X			X		
End of life management	WEEE Directive	X	X	X			X		
	Landfill directive	X	X	X	X	X	X	X	X
	Hazardous waste Directive	X	X						
	Batteries Directive				X			X	X
	ELV Directive							X	

Regulatory barriers analysis

Hazardous materials in FCHs and barriers on REACH Regulation

Affect the deployment mainly in relation to future restriction on use of hazardous materials

Critical raw materials

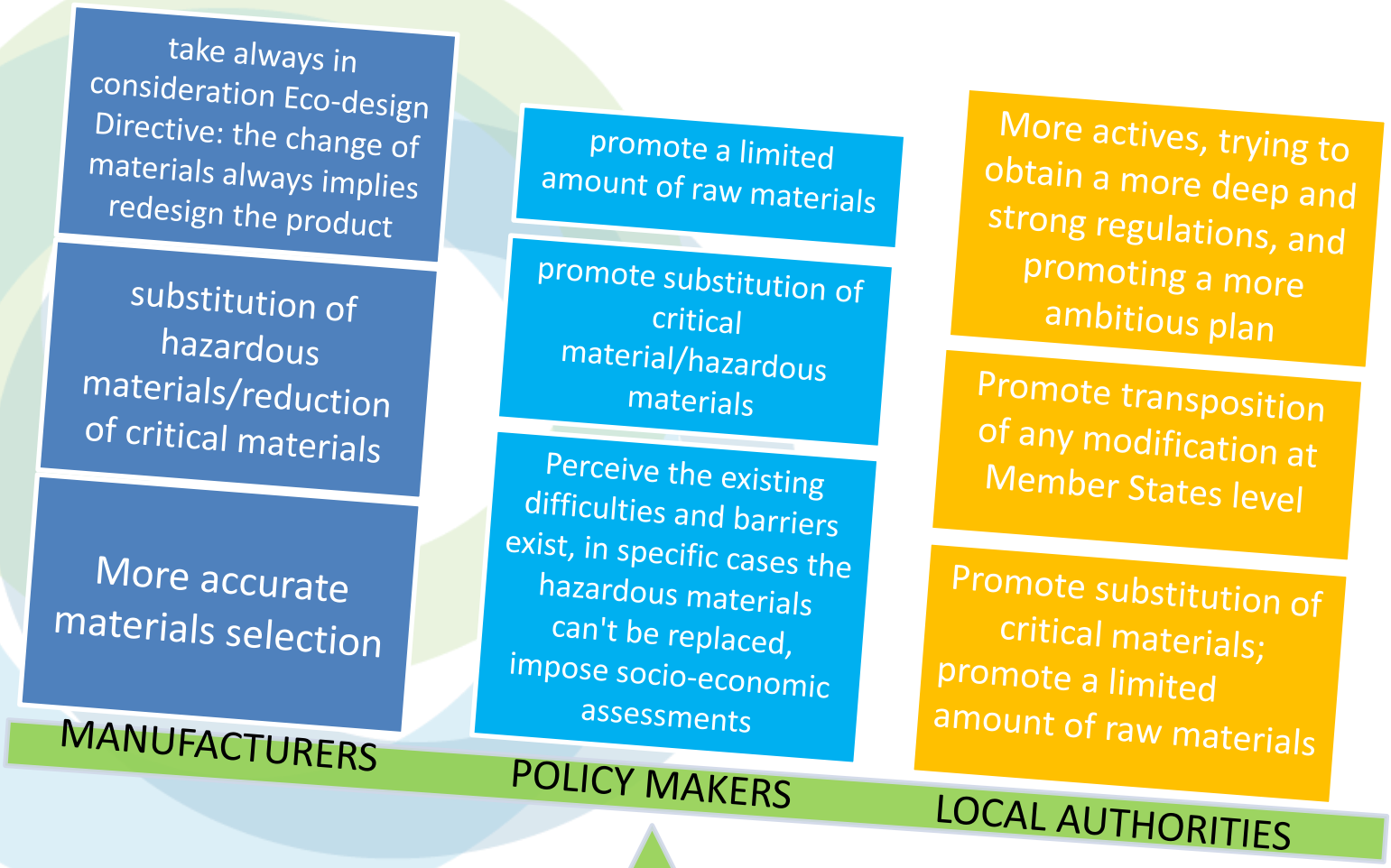
- Pt based & REE

problems mainly due to an increasing cost of materials and a decreasing availability, impact in the production system and limit its commercialization.
→Manufacturers must consider during design-phase.

Presence of specific hazardous materials

(Pb, Hg, ….) could limit commercialization or impose substitution (RoHS Directive)

Recommendations for stakeholders/target gruops



Regulatory barriers analysis

Eco-design Directive does not mention FCH technologies explicitly, but it applies to all energy products

interests of producers, users and recyclers not aligned

Reduced number of recycled materials

Eco-Design

Re-use of components?

this imply a new design of the products in order to optimized the recycling and disassembling phases:

- ✓ all agree it can be sustainable as far as the reliability of the FCSs are guaranteed if compared with FCHs mounting new components
- ✓ all think it is easier for the BoP components
- ✓ 80% of FCHs manufacturers already implement used materials in the design
- ✓ some of them are developing but mainly with the bipolar plates, but not yet developed it in the stacks
- ✓ 40% of them think as many components as possible are recycled or refurbished
- ✓ all agree the most important step is to find a suitable procedure to recycle the different components.

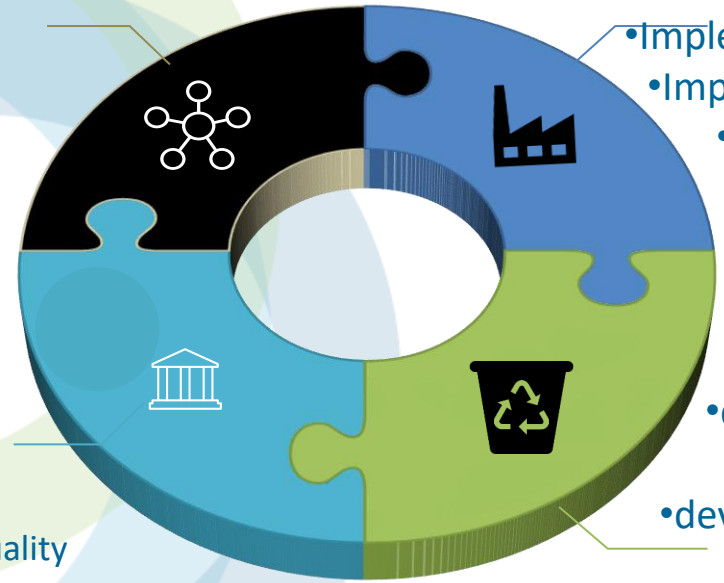
Use of recycled raw materials?

What emerged from the surveys is that the manufacturers agreed that recycled material could be used. In terms of the PGM it is a closed cycle already, cell plates and platinum are already being recycled in some cases and also some mechanical components from bipolar plates, can be recycled after an intermittent cleaning step.

Recommendations for stakeholders/target groups

•Specific agreeements between manufacturers&RCs: assure recycling centers to profit from recycling FCH technologies

• **working group** creation with the main actors involvement



MANUFACTURERS

•Harmonization of the design process in order to facilitate the dismantling stage.
•Reduction in weight and volume of the product
•Implementation a modular concept
•Improve the quality and durability
•creation of recyclability charts
•increase the rate of reused components/material

EU Policy makers& local authorities:

•promote agreements , working groups and innovation deals;
•promote eco-design;
•impose of a minimum standard of quality and durability;
•impose a rate of recycled materials used
•promote recycling
•look for new ways to promote recycling ratios, also involving society;
•reduce number of recycled materials

RCs

•develop a more environmental friendly method of recycling
•develop a more detailed research recycling methods
•guarantee the highest recycling ratio possible
•guarantee the origin of the material

Barriers and recommendation in EoL regulations

REGULATIONS	BARRIERS	MANUFACTURERS	POLICY MAKERS	LOCAL AUTHORITIES
Waste Framework	Market delay-entry: differences in national legislations as regards the definition of waste	cooperation in the definition of waste	☐ Harmonization of transboundary waste movements; ☐ Harmonisation of waste regulation in EU countries. Clarification of the "waste" and "end of waste" status and its harmonisation within different countries it is necessary to develop the market. Once a material, device, etc is classified as waste, before being use as "raw material" again, it has to be declassified as a waste. Depending on the country, this step could be not possible	more actives, trying to obtain a more deep and strong regulations, and promoting a more ambitious plan
WEEE Directive	large stationary systems out of scope	collect the main information on the product and to propose the inclusion of "large stationary power generation systems" in the WEEE Directive product list	change the scope of the Directives including also LARGE STATIONARY systems	☐ influence the change of Directive and promote transposition □ more actives, trying to obtain a more deep and strong regulations, and promoting a more ambitious plan
Landfill Directive	need of a pre-treatment prior to the disposal to landfill	find a solution for the main parts of the FCHs system and mainly the stack in order to comply with the law and enter in the market with large volumes	perceive the existing difficulties and barriers exist and to incorporate changes of regulation	□ promote transposition of any modification at Member States level □ also being more actives, trying to obtain a more deep and strong regulations, and promoting a more ambitious plan □ involvement of the society

Barriers and recommendation in EoL regulations

REGULATIONS	BARRIERS	MANUFACTURERS	POLICY MAKERS	LOCAL AUTHORITIES
Hazardous waste Directive	☐ damage the environmental beneficial image promoted by FCH manufacturers and developers ☐ delay the market entry	☐ provide a detailed life cycle assessment in order to stay below the limits in final waste and prevent damage to the technology image ☐ perform a correct choice of materials in the design phase of technology	impose a LCA analysis ijn order to guarantee the limit respect	□ promote transposition of any modification at Member States level □ also being more actives, trying to obtain a more deep and strong regulations, and promoting a more ambitious plan
ELV Directive	restrictive targets for reuse&recovery and reuse&recycle, respectively of 95% and 85% of the vehicle by weight	☐ FCH manufacturers have to consider the target and transpose it mainly to the Fuel cell stack ☐ Look for a progressive reuse and recycle ratio in FCEV vehicles, as far as the technology is not widely implemented yet.	impose ratio of reused and recycled materials	promote transposition of any modification at Member States level

Codes and Standards in RCs

Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products **ECO-design directive**

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives referred to as **Waste Framework Directive** or **WFD**

Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste last amended by Council Directive 2011/97/EU of 5 December 2011 referred to as **Landfill Directive** complemented by 2003/33/EC: Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC

Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) **IPPC Directive**

Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment **RoHS Directive**

Codes and Standards in RCs

Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) **WEEE Directive**
Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles - Commission Statements **ELV Directive**
Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC **Batteries Directive**
Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC **REACH**
REGIONAL OR LOCAL LICENCES, FACILITY OR MANAGEMENT PERMIT, REGISTRATION OR PRIOR NOTICE OR OTHER ADDITIONAL

Similarities

DIRECTIVES	MANUFACTURERS	RECYCLING CENTERS
Eco Design Directive	X	X
REACH Regulation	X	X
RoHS Directive	X	X
WEEE Directive	X	X
Landfill directive		X
Hazardous materials Directive	X	
Batteries Directive	X	X
ELV Directive	X	X
Waste Framework Directive		X
Integrated Prevention Pollution and control		X

Disassembly differences

Manufacturers estimation of time (hours) for the disassembly time by their operator in their facilities:

PEMFC	2
PEMWE	28
AWE	16
SOFC	3

Nevertheless, the general purpose recycling centre expect higher times due to their operators, what increase the recycling costs.

¿How to solve this?

The idea is here to raise modularity and to help in the disassembly stages.

Conclusion


Propose specific FCH Directives
provide evidence of Eco-design improve the choice of materials
Organize Working group and settle agreements
Reduce the use of hazardous materials
focus on strategies for end-of-life management

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