



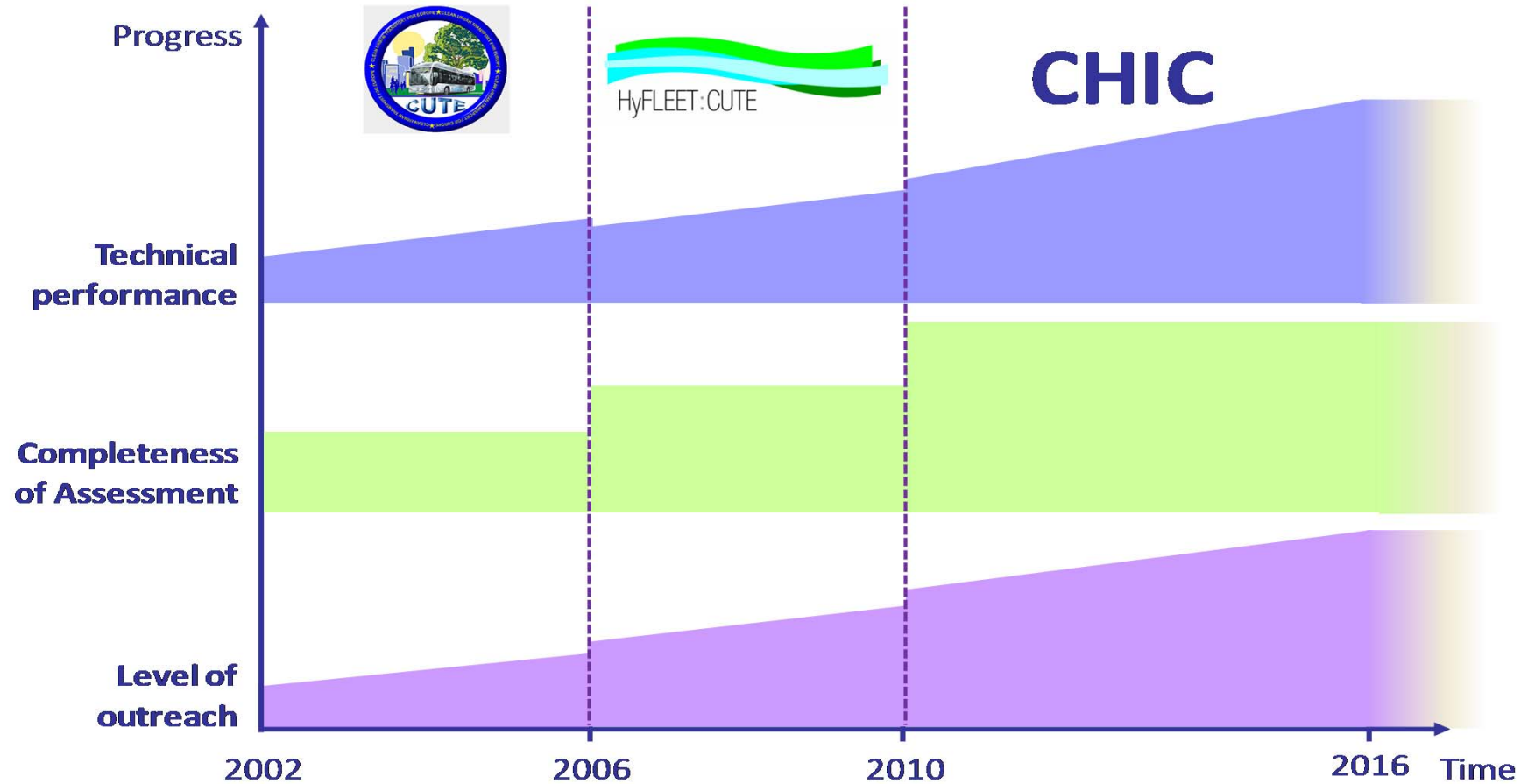
FC-Hy  
Guide

**Operational LCA  
guidance for hydrogen  
production**

**6. September 2012  
Stuttgart**

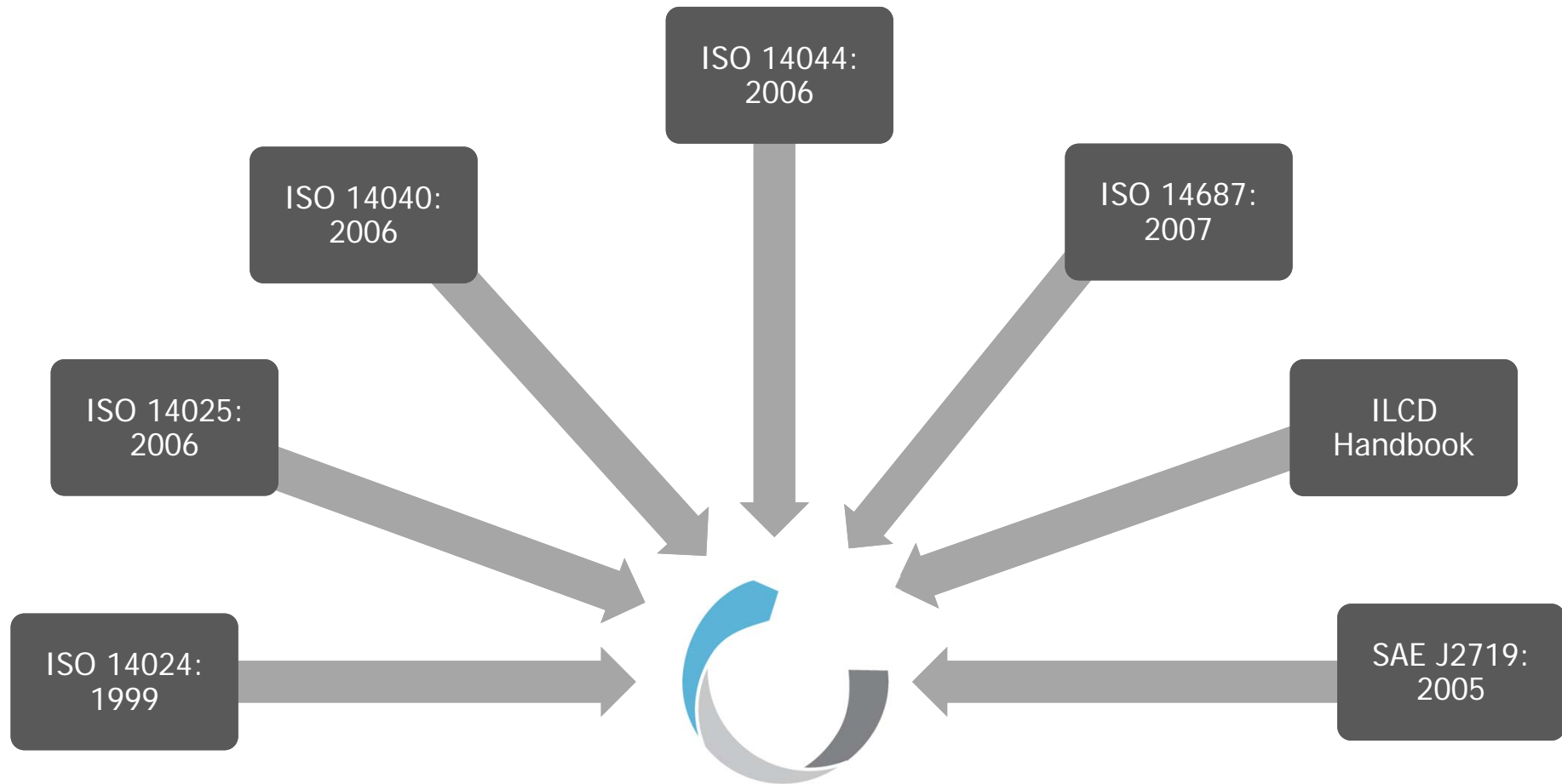
# LCA GUIDANCE FOR ASSESSING HYDROGEN PRODUCTION - METHODOLOGICAL APPROACH AND RESULTS

**A. Lozanovski**

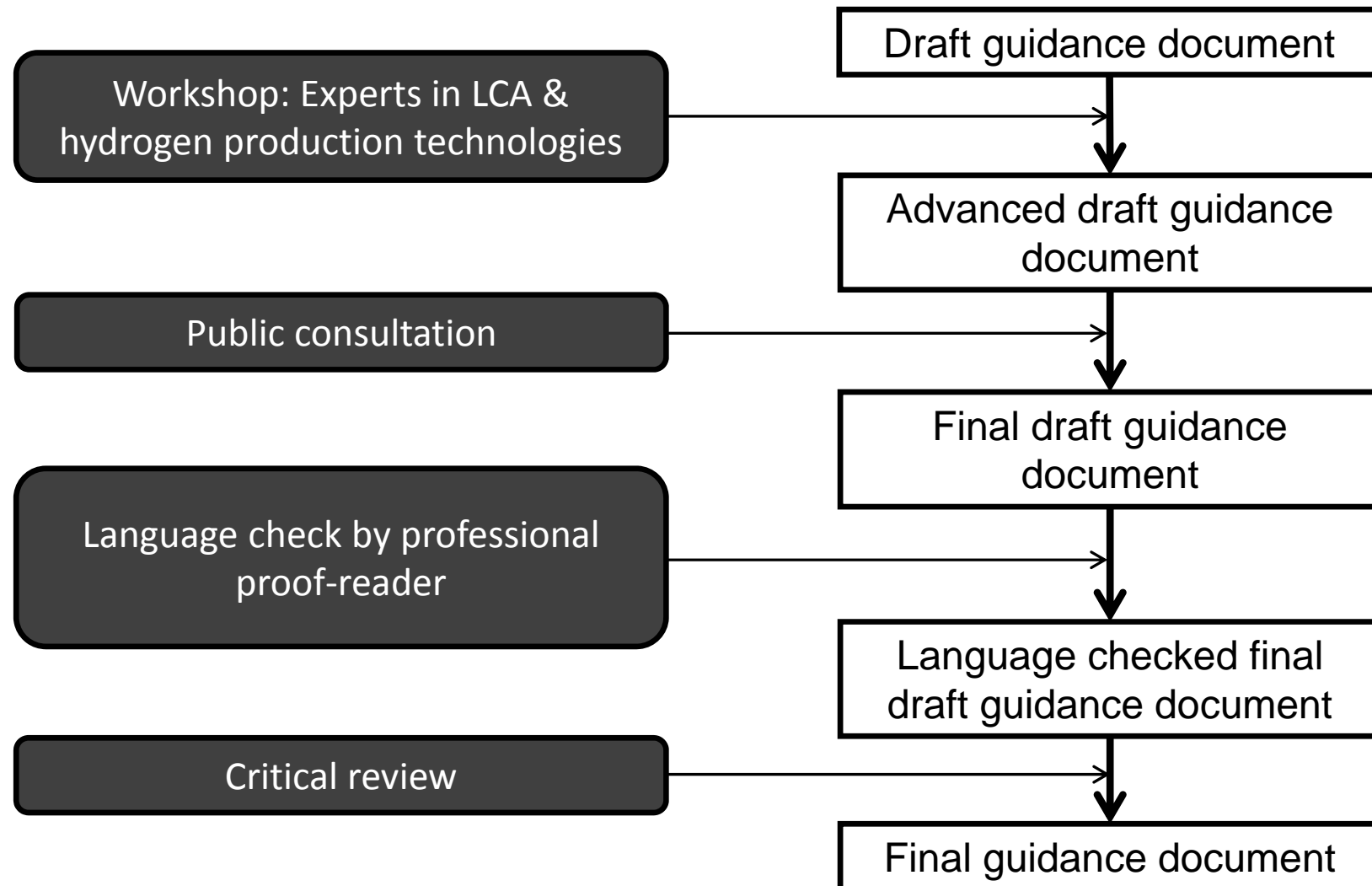


- Sector specific tailor-made guidance document for hydrogen production
- Funded by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU)

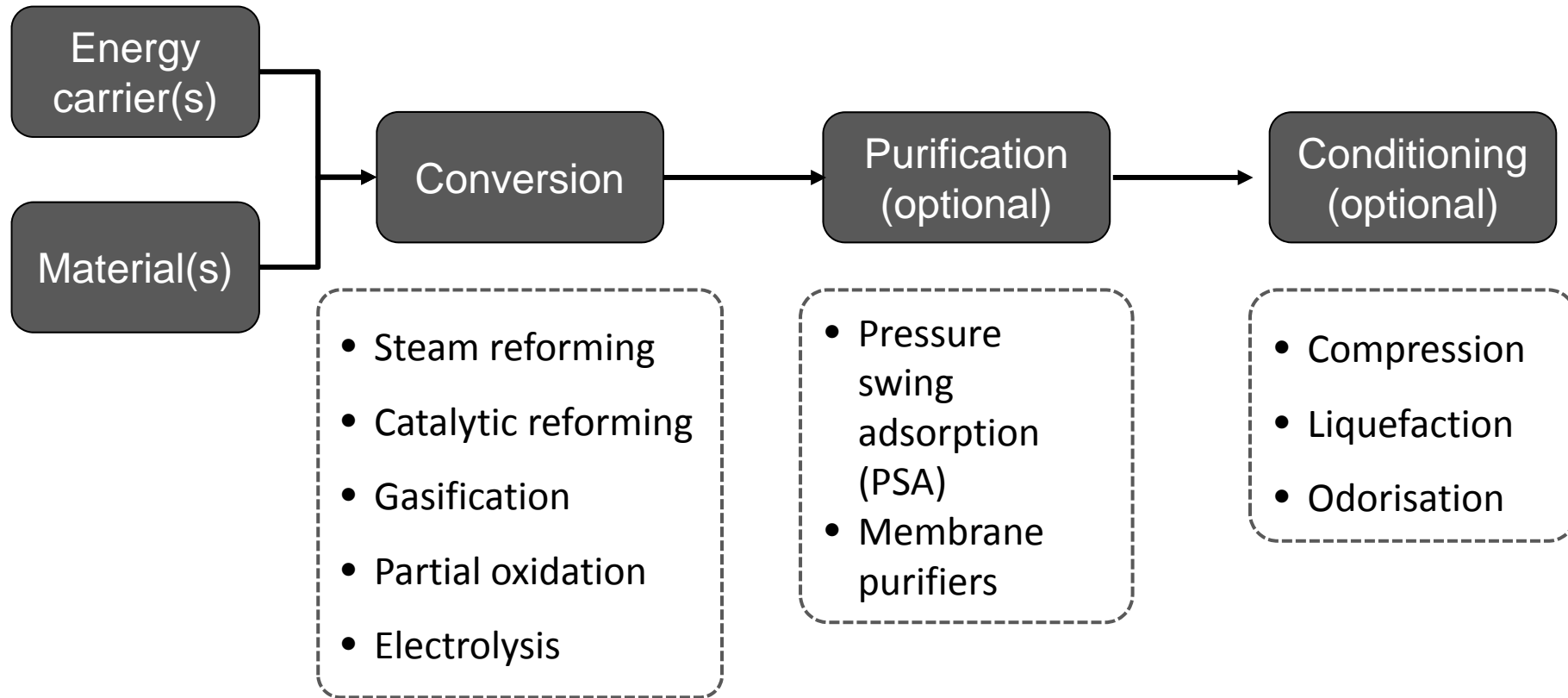
# Basis of the guidance document



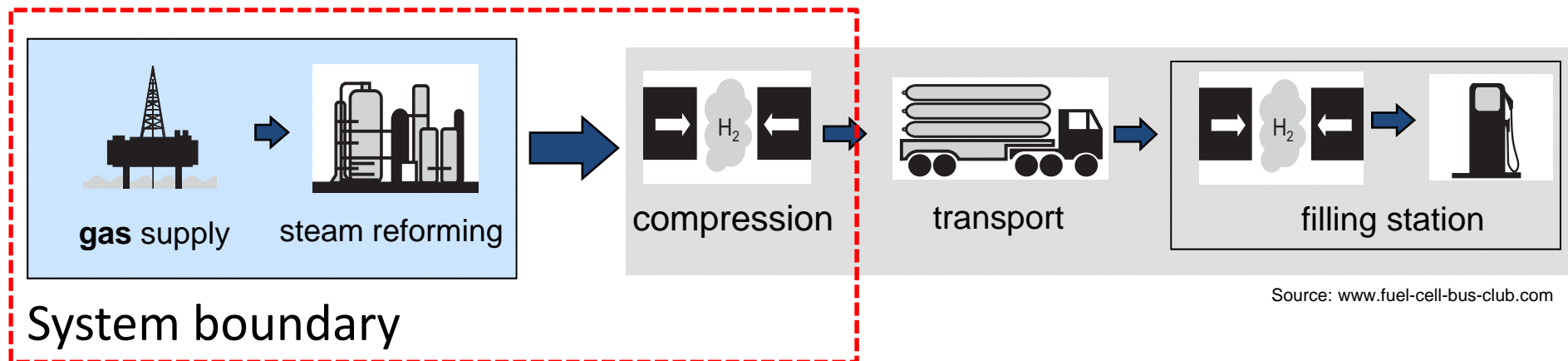
# Preparation of the guidance document



# Evaluation of hydrogen pathways

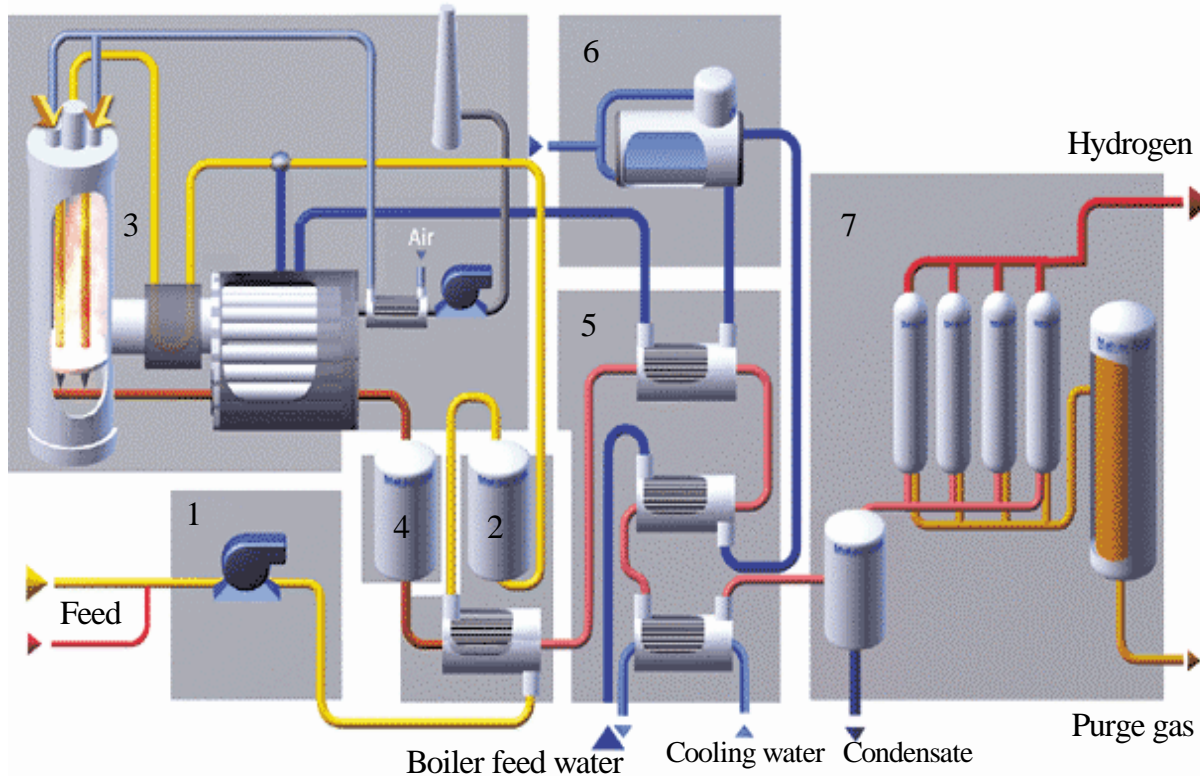


- Information of the facility and the hydrogen
- Function, functional unit and reference flow:  
*1MJ H<sub>2</sub> @ XX bar, YY °C, ZZ,ZZ% purity*



Source: [www.fuel-cell-bus-club.com](http://www.fuel-cell-bus-club.com)





- Planning data collection
- Collection of unit process data
- Filling data gaps and usage of background data sets (e.g. ILCD)
- Set up of LCA model(s)
- Calculation of LCI results

1	Compression	5	Heat recovery
2	Desulfurisation and Hydrogenation	6	Generation of Steam
3	Reforming	7	Purification by PSA
4	CO-Conversion		

Source: [www.fuel-cell-bus-club.com](http://www.fuel-cell-bus-club.com)

# 3. Data collection questionnaire – general part –

Part I: General information on hydrogen production		unit
<b>Please attach an additional sheet including a system functioning scheme and system's basic components</b>		
<b>Hydrogen related information</b>		
<i>[please add rows and other fields if needed]</i>		
Purity of the hydrogen (XX %)		%
Aggregate state (liquid or gaseous) of the hydrogen		
Pressure of the hydrogen (YY bar)		bar
Temperature of the hydrogen (ZZ °C)		°C
Impurities (please state them below, if known)		%
Type of Impurities		
Amount		%
Quantity produced by volume		Nm <sup>3</sup> /h or Nm <sup>3</sup> /year
Quantity produced by mass		kg/h or kg/year
<b>Description of hydrogen producer (general information on the producer)</b>		
<i>[please add rows and other fields if needed]</i>		
Overall hydrogen production capacity (of the production company)		m <sup>3</sup>
Number of hydrogen production sites		No.
Hydrogen production technologies used (e.g. steam reformer, electrolysis etc.)		
Geographical coverage by region (where are the major production locations of the producer)		country or region
<b>Description of the product system under investigation</b>		
<i>[please add rows and other fields if needed]</i>		
Hydrogen production technology used		
Location of the production site		country or region
Year of construction		
Is there electricity produced on-site used		yes/no
Amount of electricity produced on-site used (if applicable)		kWh/MJ hydrogen
Type of electricity production on-site (if applicable)		
Is there heat produced on-site used in the production of H <sub>2</sub>		
Type of heat production on-site, e.g. gas boiler, oil CHP etc. (if applicable)		
Amount of heat production on-site (if applicable)		MJ/MJ hydrogen
H <sub>2</sub> production capacity per day		Nm <sup>3</sup> /year or MJ/year
H <sub>2</sub> production capacity per year		Nm <sup>3</sup> /year or MJ/year
Technical service life of H <sub>2</sub> production		
Scale of production site (laboratory, pre-commercial, commercial scale)		
Type of storage (including e.g. liquefaction facility or other device)		
Capacity of storage		Nm <sup>3</sup>

# 3. Data collection questionnaire – specific part –

Part II: Hydrogen production by steam reforming		amount (per unit of product)	unit
<b>Hydrogen production - Functional unit is "1 MJ of hydrogen (net calorific value (NCV) with XX % purity and YY bar"</b>			
<i>[please add rows and other fields if needed]</i>			
<b>Input</b>			
Natural gas (if applicable)		Nm <sup>3</sup> /MJ hydrogen	
Net calorific value of the natural gas used		MJ/Nm <sup>3</sup>	
Liquefied petroleum gas (if applicable)		kg/MJ hydrogen	
Net calorific value of the liquefied petroleum gas used (if applicable)		kg/Nm <sup>3</sup>	
Refinery gas (if applicable)		Nm <sup>3</sup> /MJ hydrogen	
Net calorific value of the refinery gas used (if applicable)		MJ/Nm <sup>3</sup>	
Other process gases (e.g. off gas from H <sub>2</sub> purification) (please specify if applicable)		m <sup>3</sup> /MJ hydrogen	
Net calorific value of the process gas used (if applicable)			
Composition of the process gas (e.g.% H <sub>2</sub> , % CO <sub>2</sub> etc.) (if applicable)			
Cooling water			
Temperature of the cooling water			
Tap water			
Average temperature of the tap water			
Electricity			
Operating supplies and spare parts (e.g. kg catalyst for reformer)			
Operating supplies for the desulphurisation (e.g. kg catalyst per year)			
Operating supplies for the de-ioniser (if applicable)			
<b>Output</b>			
CO <sub>2</sub> (Emissions)			
NO <sub>x</sub> (Emissions)			
CO (Emissions)			
Other emissions (please specify)			
Waste water			
Miscellaneous waste			
Amount of H <sub>2</sub> losses during purification			
Are the H <sub>2</sub> losses used as process gas? (if yes please specify in process gas column above in inputs)			
<b>Part III: Hydrogen production by electrolysis</b>		amount (per unit of product)	unit
<b>Hydrogen production - Functional unit is "1 MJ of hydrogen (net calorific value (NCV) with XX % purity and YY bar"</b>			
<b>Method of production: Alkaline electrolysis</b>			
<i>[please add rows and other fields if needed]</i>			
<b>Input</b>			
Electricity		kWh/MJ hydrogen	
Tap water		m <sup>3</sup> /MJ hydrogen	
Potassium hydroxide		kg/MJ hydrogen	
Process gases (e.g. off gas from H <sub>2</sub> purification) (please specify if applicable)		m <sup>3</sup> /MJ hydrogen	
Net calorific value of the process gas used (if applicable)		MJ/m <sup>3</sup>	
Composition of the process gas (e.g.% H <sub>2</sub> , % O <sub>2</sub> etc.) (if applicable)			
Operating supplies and spare parts			
<b>Output</b>			
Is the Oxygen used? (Please state the amount below if yes)		yes/no	
Oxygen		Nm <sup>3</sup> /MJ hydrogen	
Amount of H <sub>2</sub> losses during purification		%	
Are the H <sub>2</sub> losses used as process gas? (if yes please specify in process gas column above in inputs)		yes/no	
Other emissions (please specify)		kg/MJ hydrogen	

- Hydrogen service station Hamburg-Hummelsbüttel CUTE-Project
- Basic facts:
  - 99.995 % purity
  - 440 bar @ 85°C (350 bar @ Ambient temperature)



- Guide for current and upcoming technologies
- Strict rules and possibility to fit taylor-made solutions
- Comparability between the different hydrogen technologies

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