



Los electrolizadores y su rol en la descarbonización

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Introducción



<https://www.gta-homes.com/real-insights/market/gta-expected-to-grow-40-per-cent-by-2041/>



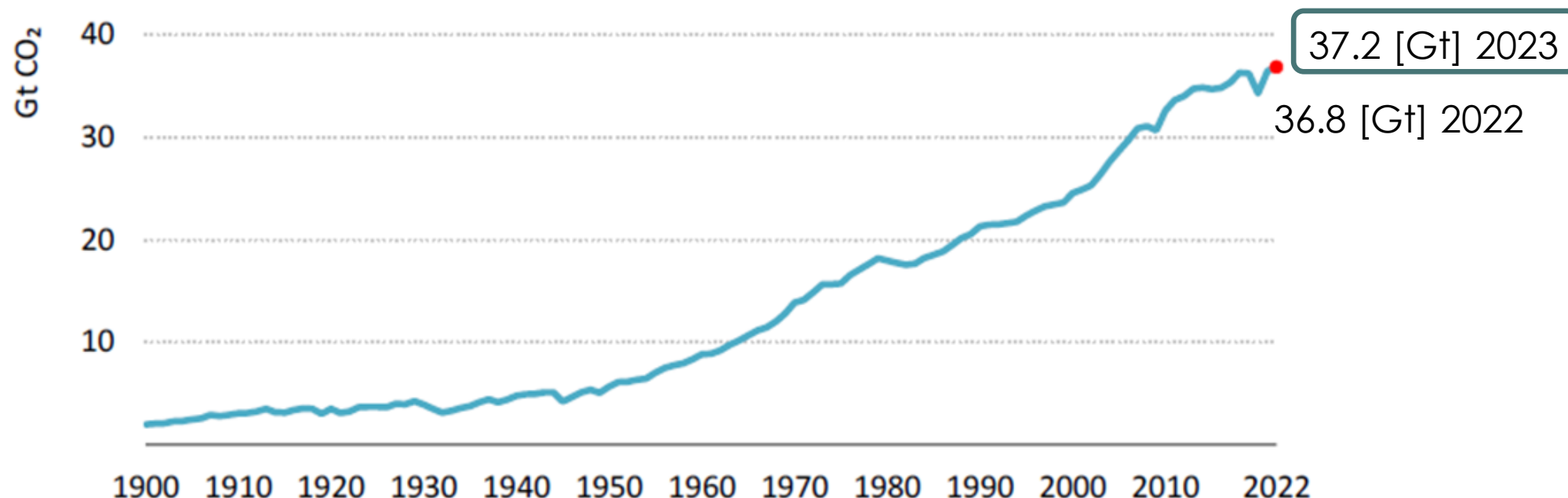
<https://create.vista.com/photos/electronics/>



<http://www.transferproject.org/reference-document-on-measurement-reporting-and-verification-mrv-in-the-transport-sector/>

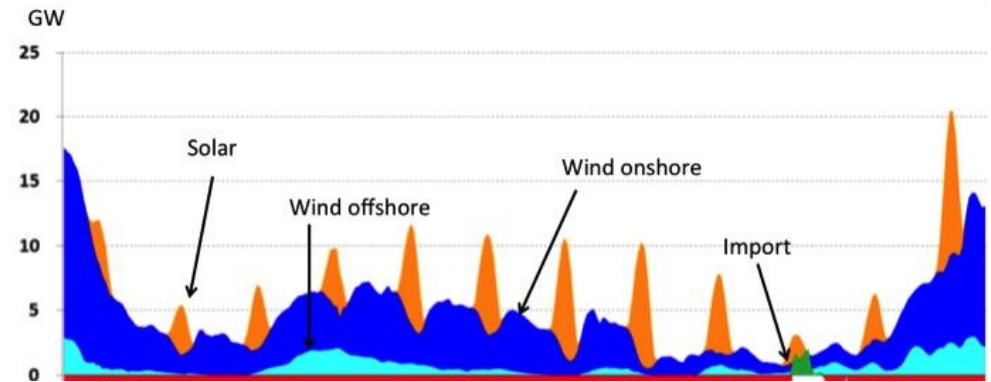
Emisiones globales de CO₂ desde 1900 al 2023

3

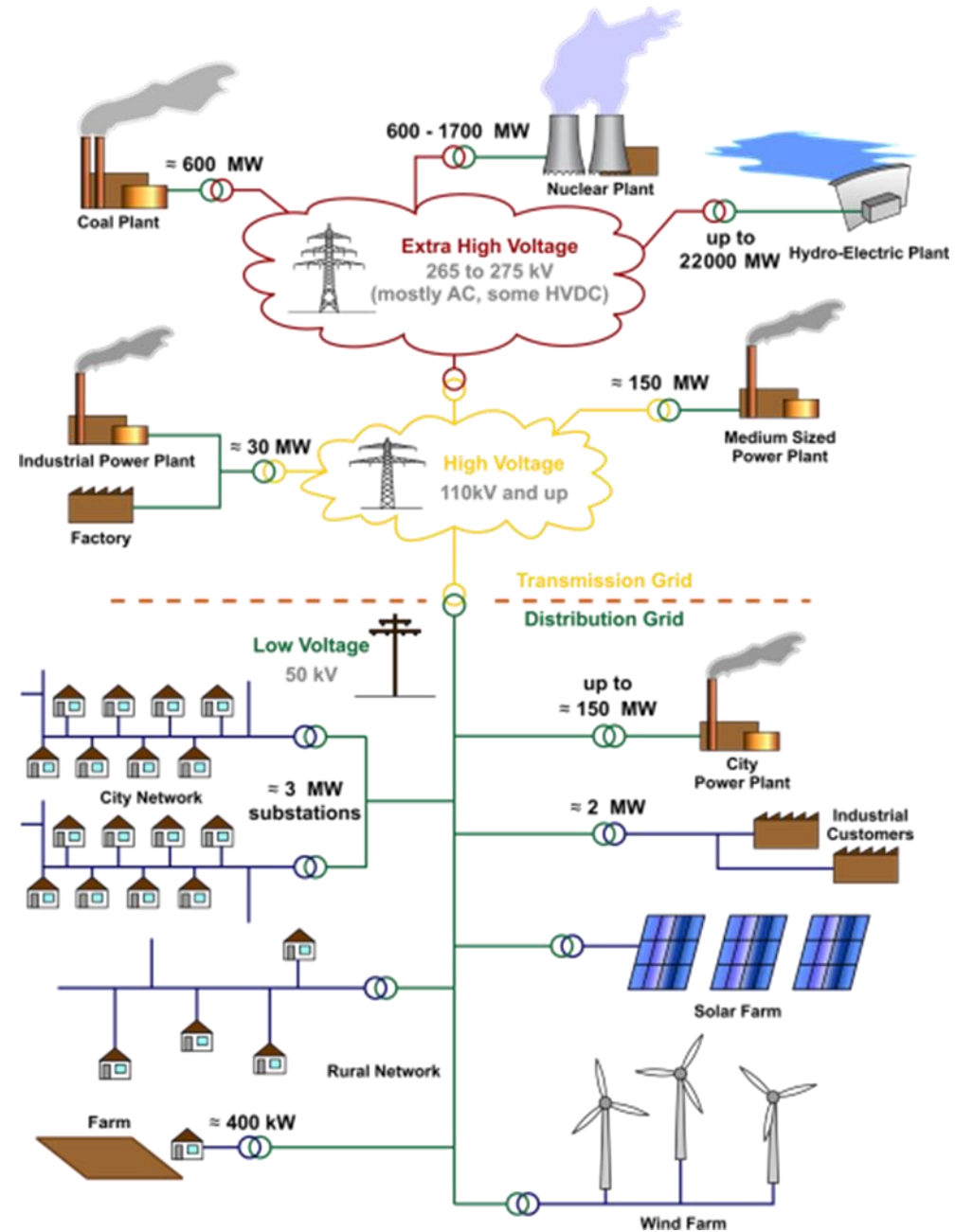


CO₂ Emissions in 2022. IEA Publications. International Energy Agency. Website: www.iea.org

Energías Renovables

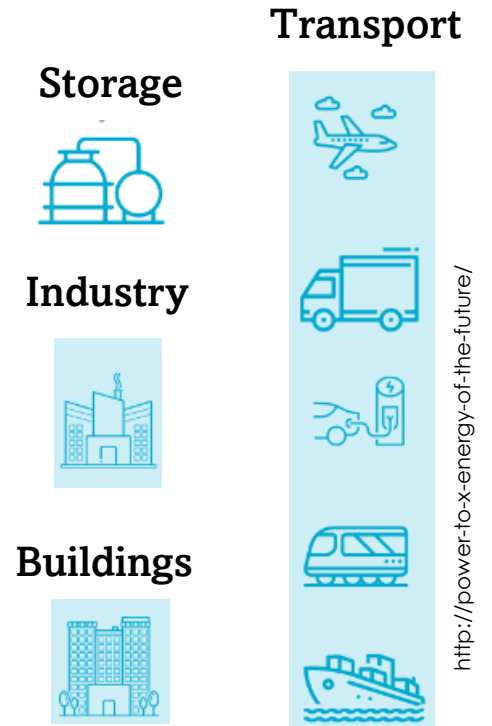
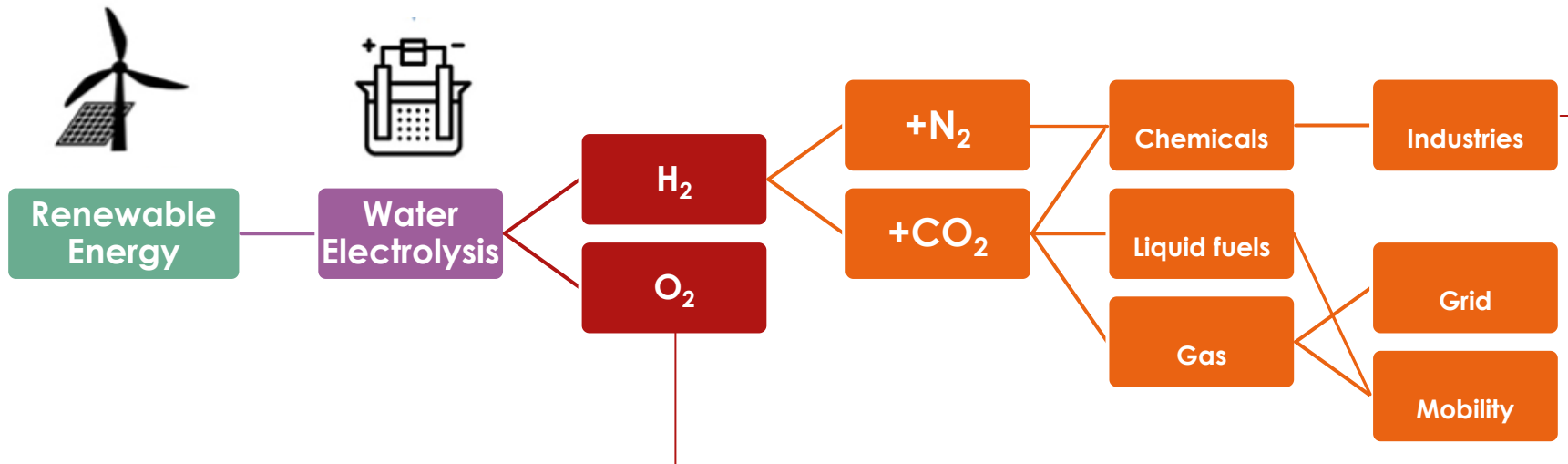


<https://www.wind-watch.org/documents/hidden-consequences-of-intermittent-electricity-production/>



https://en.wikipedia.org/wiki/Electrical_grid

Tecnologías "Power to X"

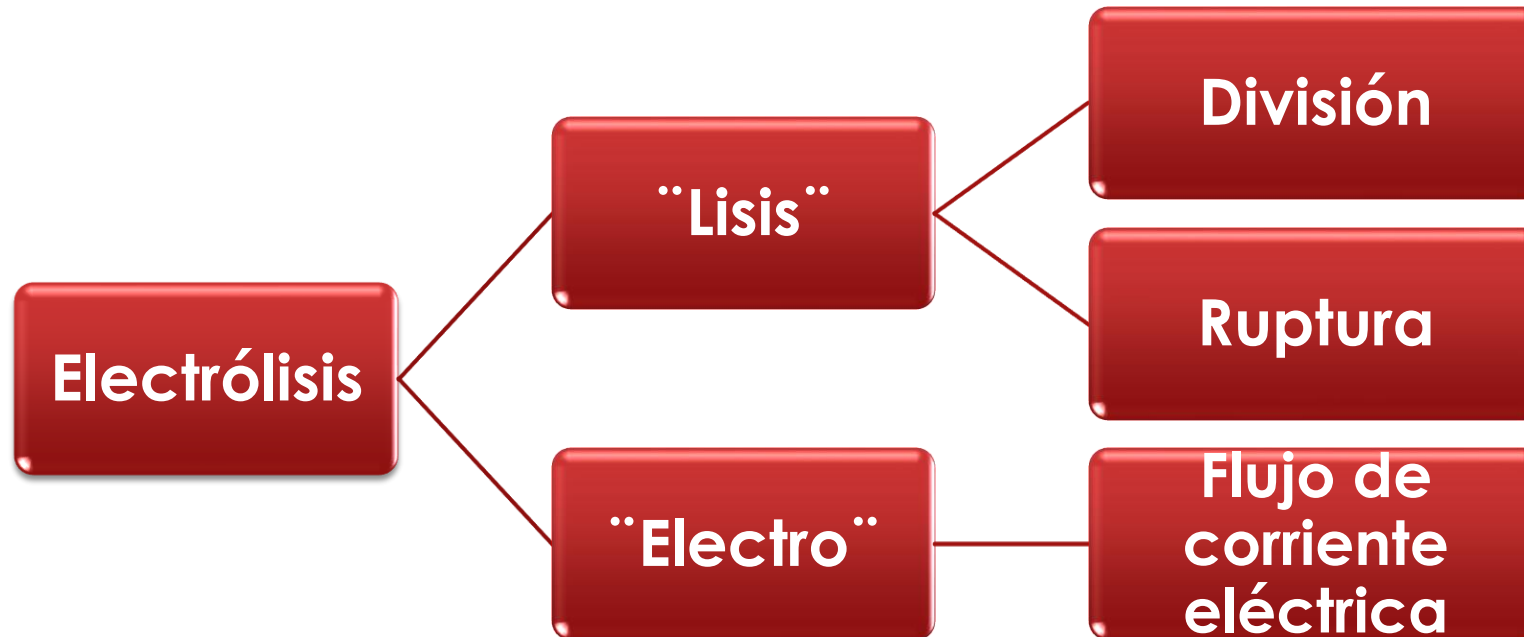


Schematic representation of "power to X" conversi3n pathways

Recent development in Power-to-X: Part I - A review on techno-economic analysis Ahmed Rufai Dahiru, Ari Vuokila, Mika Huuhtanen (2022) Journal of Energy Storage 56.

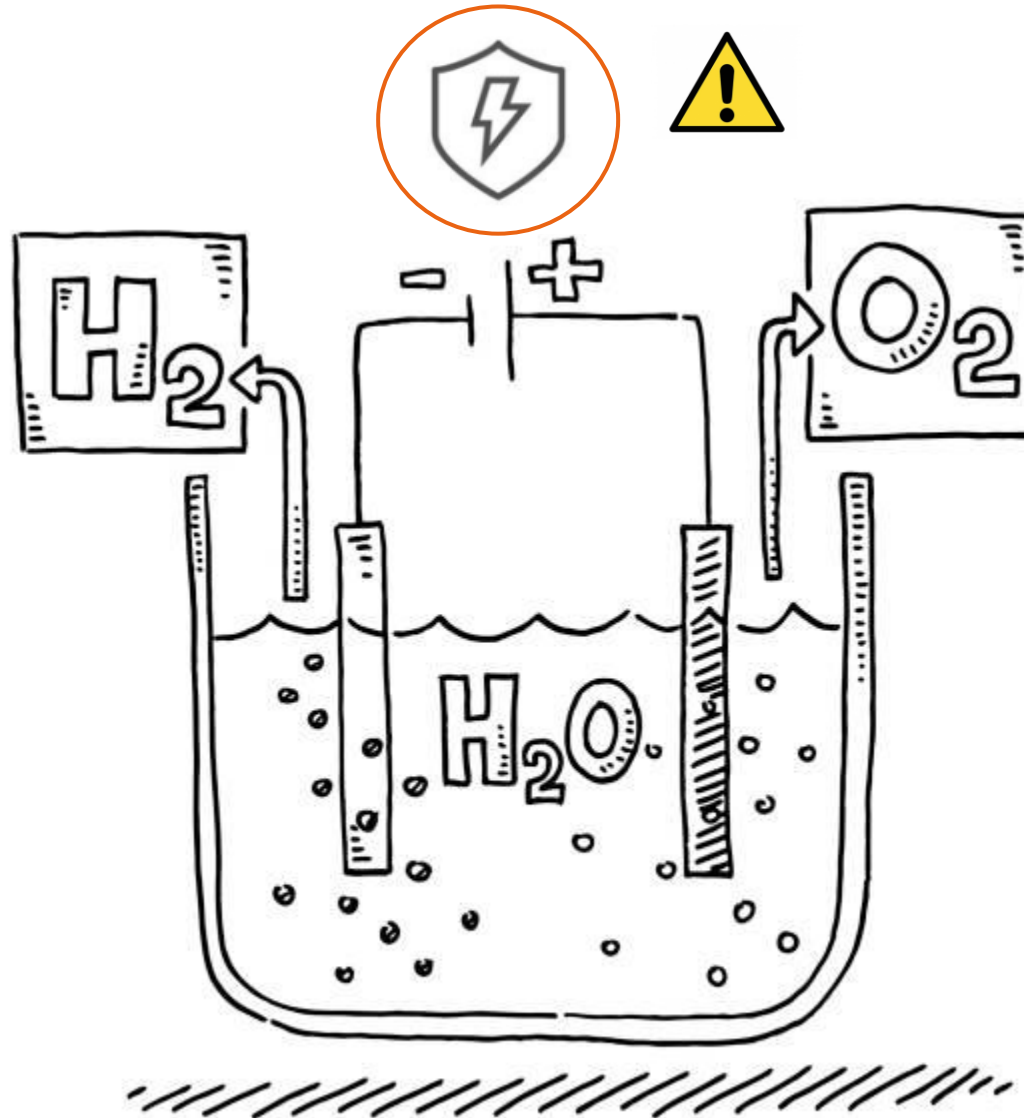
Electrólisis del agua

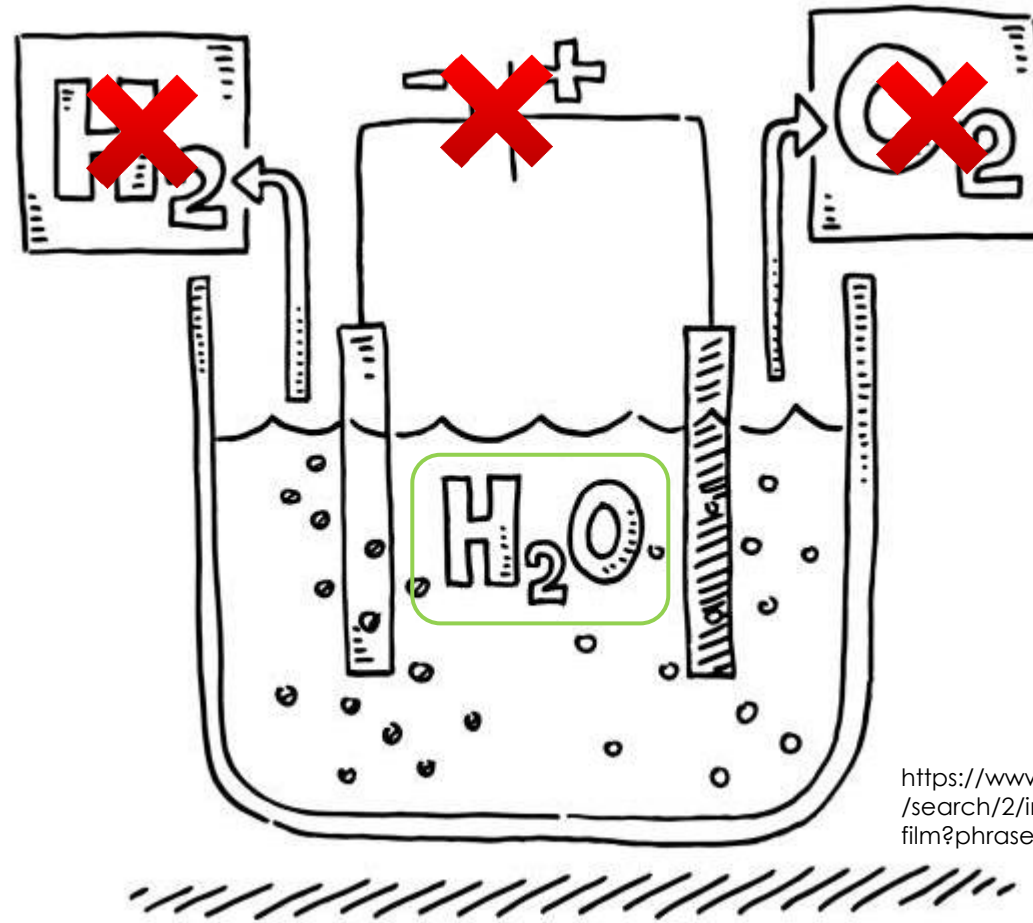
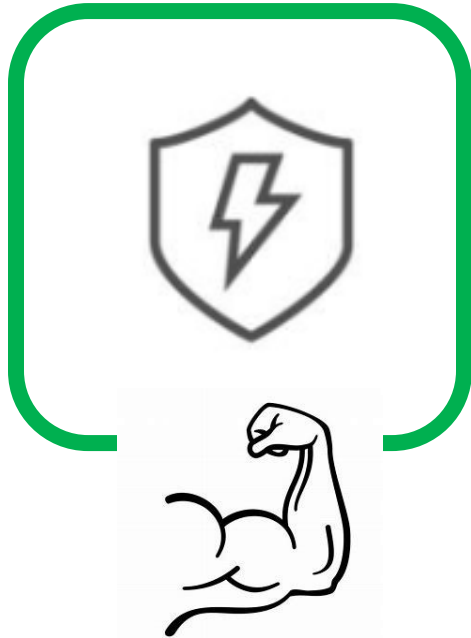
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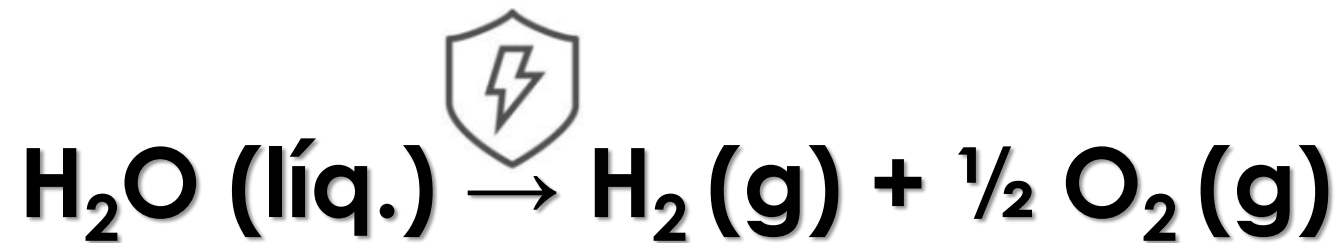
Electrólisis del agua

8

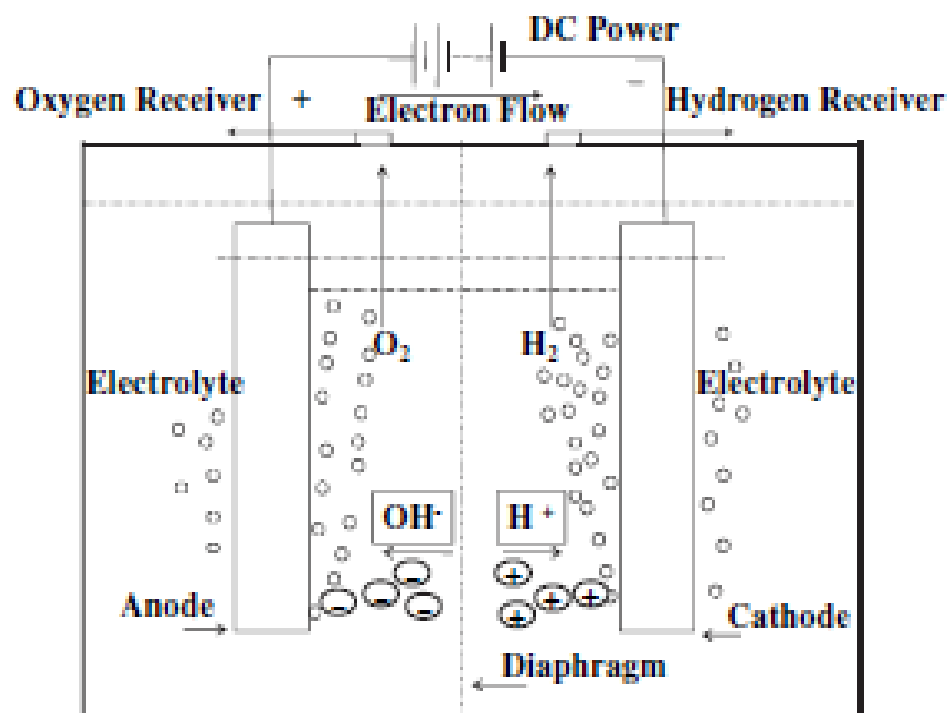




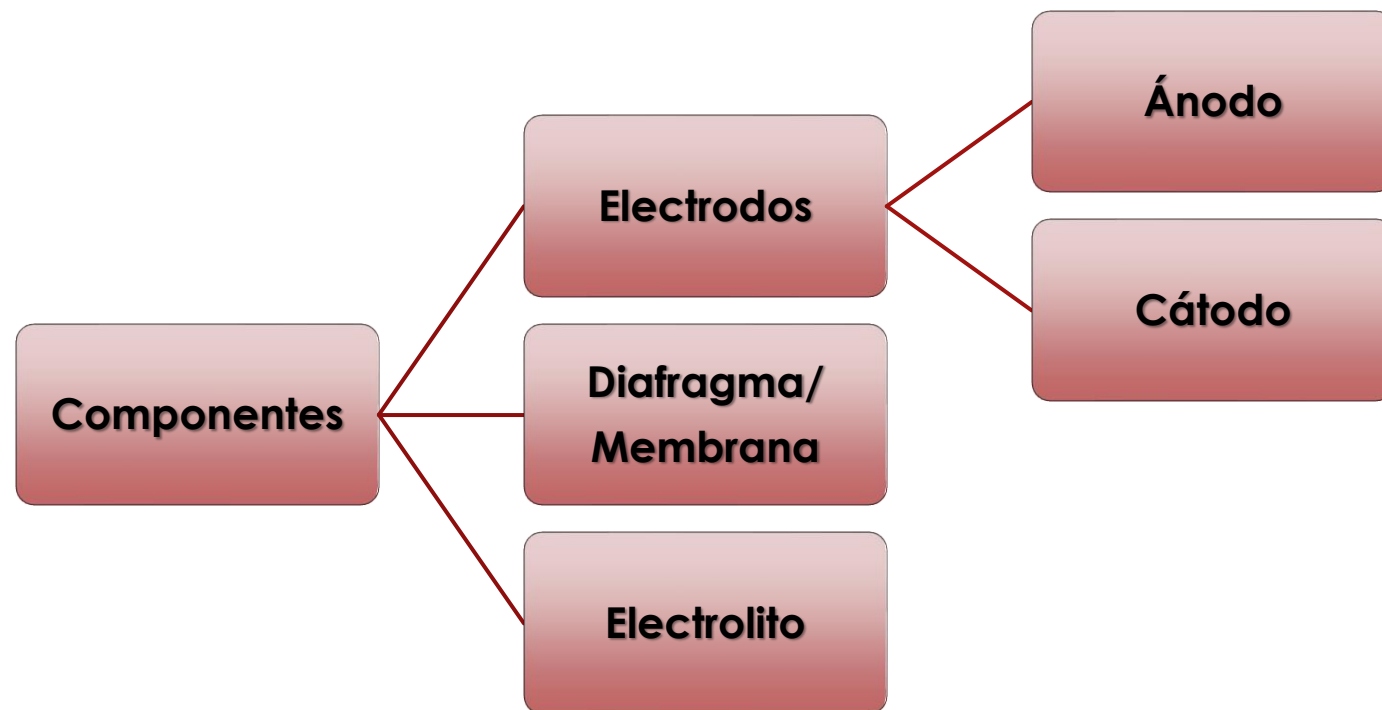
<https://www.istockphoto.com/search/2/image-film?phrase=water+electrolysis>



Unidad básica



Esquema ilustrativo de una celda unidad de un electrolizador alcalino



Tipos de electrolizadores

Tipos

Alcalinos [AKL]

Membrana de electrolito
polimérico[PEM]

Óxido Sólido [SOEC]

Membrana de intercambio
de aniones[AEM]

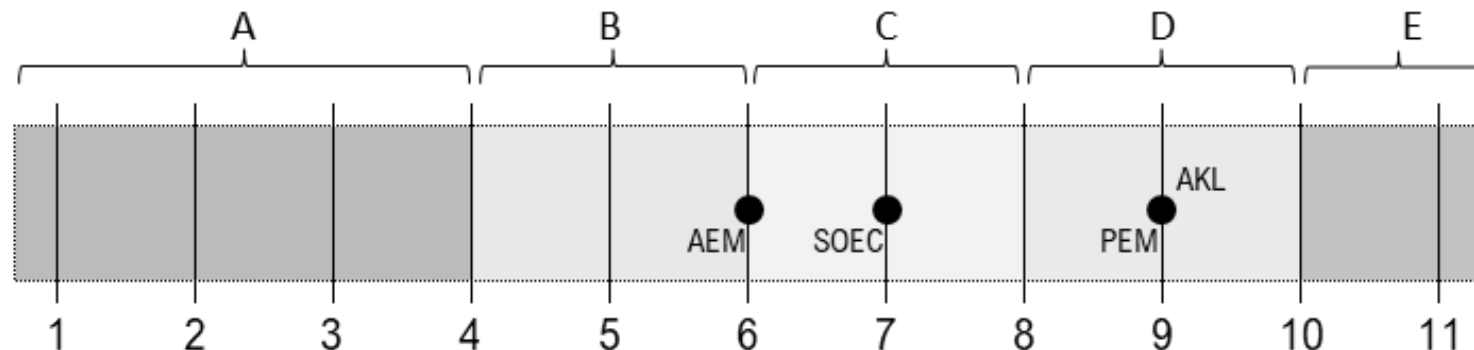
Tipos	Ánodo	Cátodo
AKL and AEM	$2\text{OH}^{1-} \rightarrow \frac{1}{2} \text{O}_2 + \text{H}_2\text{O} + 2\text{e}^{1-}$	$2\text{H}_2\text{O} + 2\text{e}^{1-} \rightarrow \text{H}_2 + 2\text{OH}^{1-}$
PEM	$\text{H}_2\text{O} \rightarrow \frac{1}{2} \text{O}_2 + 2\text{e}^{1-} + 2\text{H}^{1+}$	$2\text{H}^{1+} + 2\text{e}^{1-} \rightarrow \text{H}_2$
SOEC	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^{1-}$	$\text{H}_2\text{O} + 2\text{e}^{1-} \rightarrow \text{H}_2 + \text{O}^{2-}$

Condiciones de operación y materiales

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Type	AKL	PEM	SOEC	AEM
Operating temperature	70-90 °C	50-80 °C	700-850 °C	40-60 °C
Cell pressure	1-30 bar	< 70 bar	< 1 bar	< 35 bar
H ₂ purity	99,5–99,9998 %	99,9–99,9999 %	99,9 %	99,9–99,9999 %
Electrolyte	KOH/NaOH	PFSA membrane	YSZ	DVB polymer support with KOH or NaHCO ₃
Separator	IrO ₂ stablized with PPS	PFSA membrane	YSZ	DVB polymer support with KOH or NaHCO ₃
Anode/electro-catalyst	Nickel coated perforated stainless steel	IrO ₂	Perovskites (LSM) (La,Sr,Mn)	Ni or NiFeCo alloys
Cathode/electro-catalyst	Nickel coated perforated stainless steel	Platinum carbon	Ni/YSZ	Ni mesh
Frames and sealers	PSU, PTFE, EPDM	PTFE, PSU, ETFE	Ceramic glass	PTFE, silicon

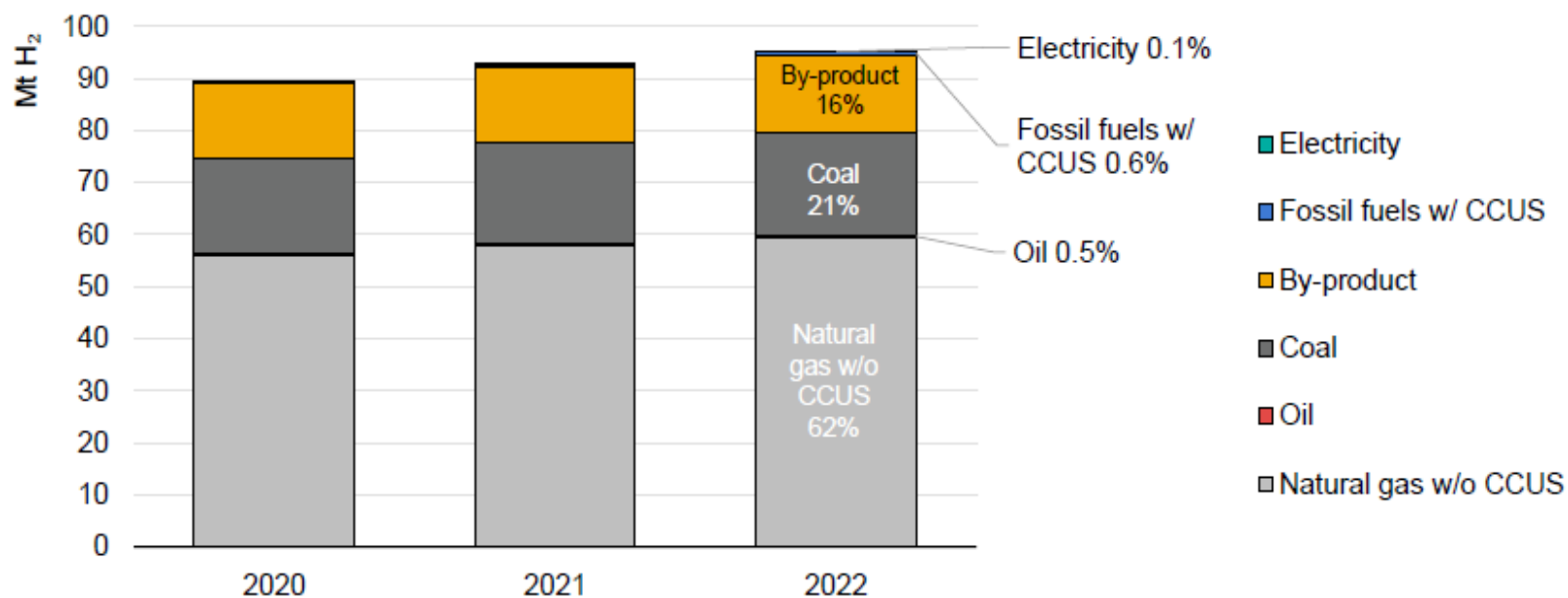
Niveles de madurez tecnológica



- A – Small prototype
- B – Large prototype
- C - Demonstration
- D – Market uptake
- E - Mature

Producción de H₂ por tecnología

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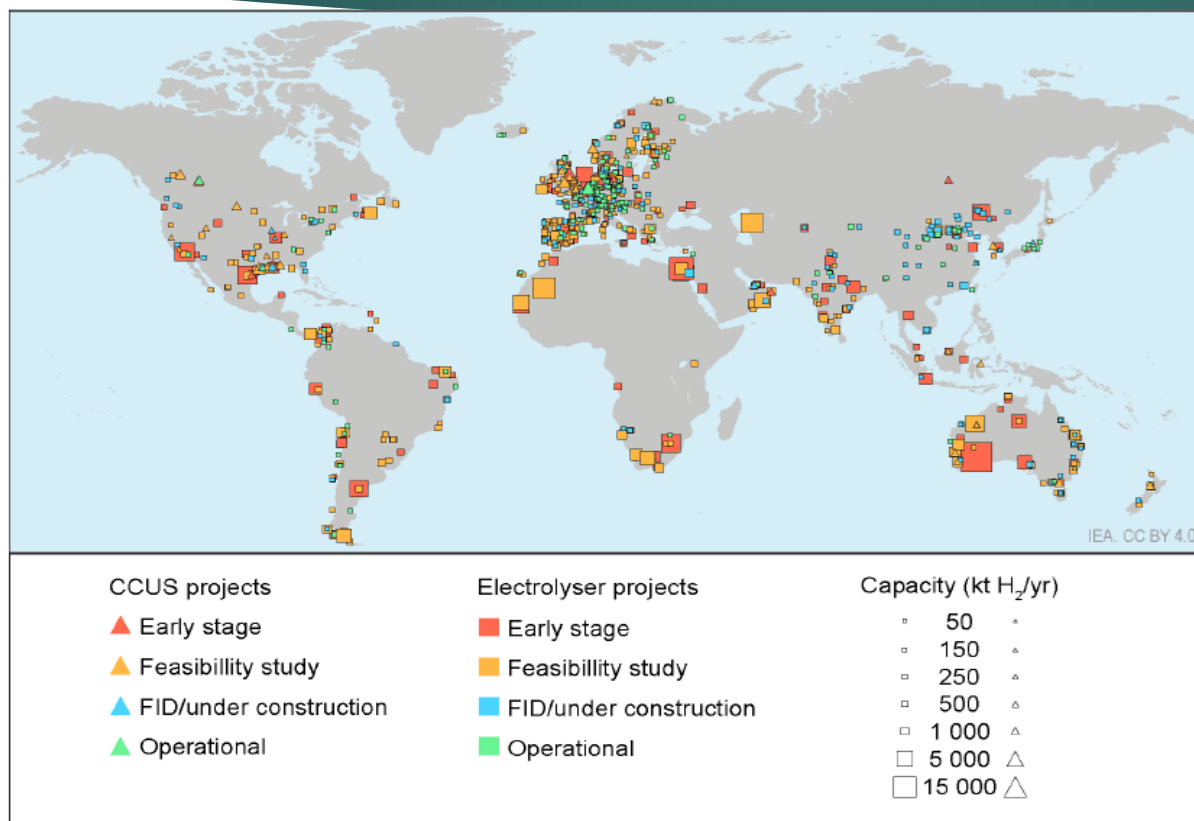
IEA. CC BY 4.0.

Note: CCUS= carbon capture, utilisation and storage.

<https://www.iea.org/reports/global-hydrogen-review-2023>

Producción de hidrógeno de bajas emisiones

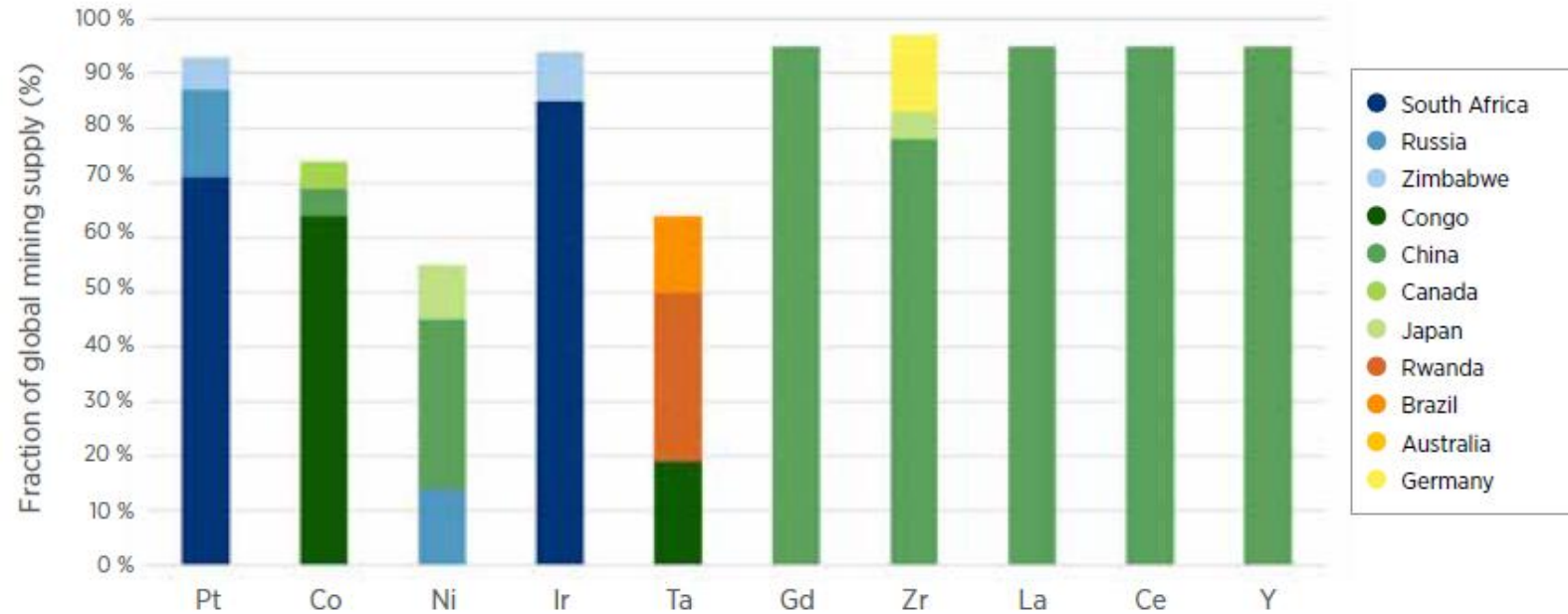
15



Mapa de proyectos anunciados

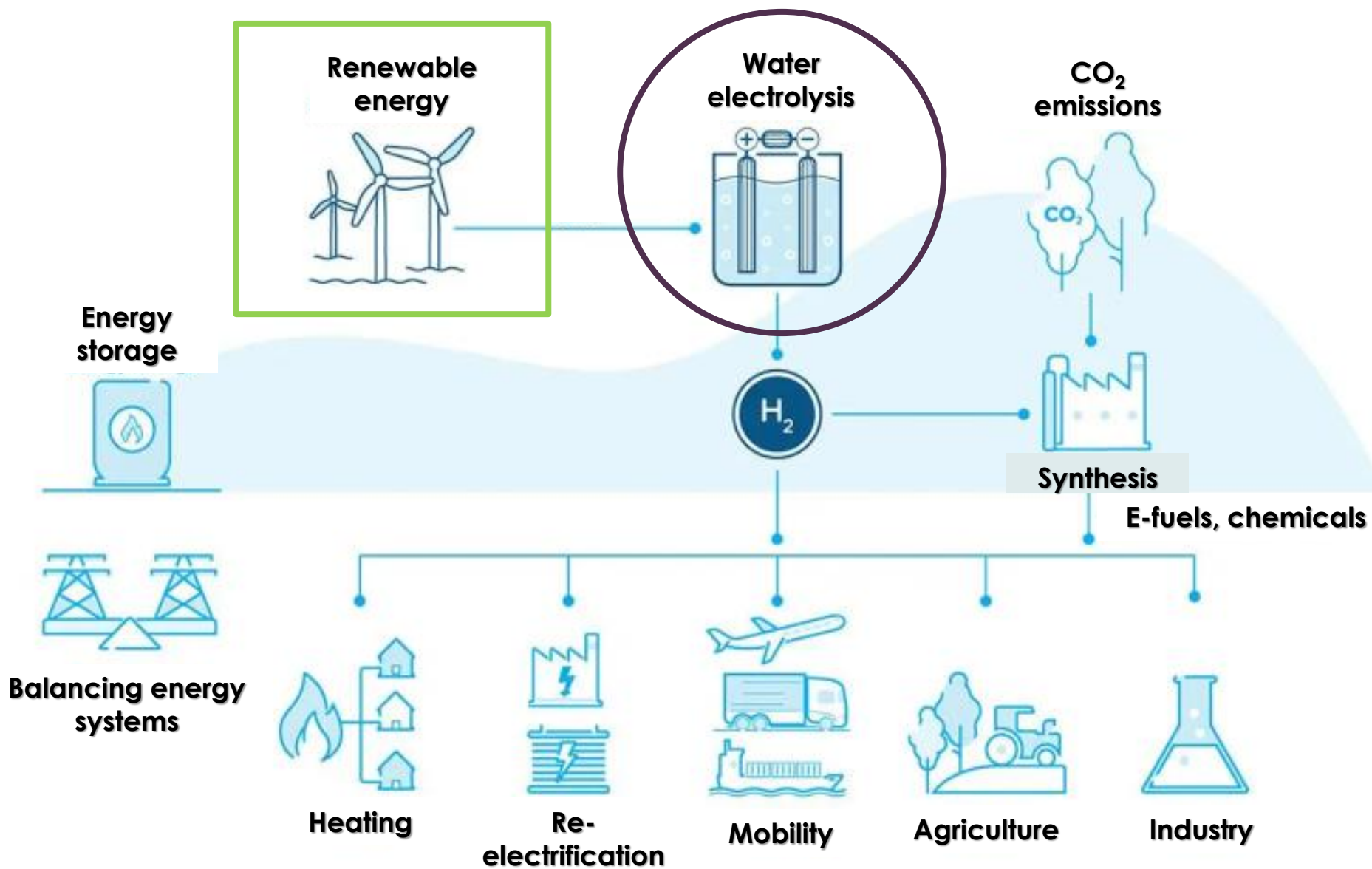
<https://www.iea.org/reports/global-hydrogen-review-2023>

Note: Map also includes announced projects starting after 2030.
Source: [IEA Hydrogen Projects](#), (Database, October 2023 release).

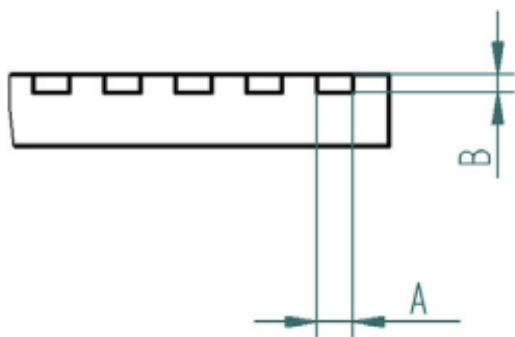


Source: European Commission, 2020.

Materiales críticos



Geometrías/Topologías



Recto-Paralelo

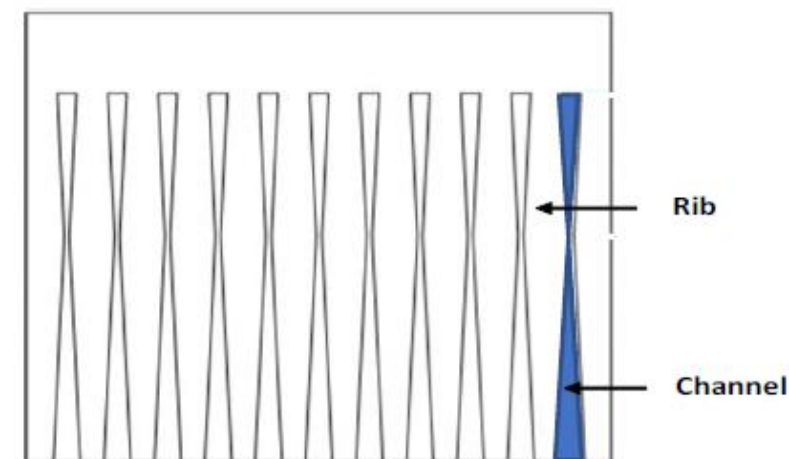
<https://doi.org/10.1016/j.ijhydene.2016.02.096>

<https://doi.org/10.1155/2019/5392452>



Ondulados

Hyceltec 2022 libro de resúmenes



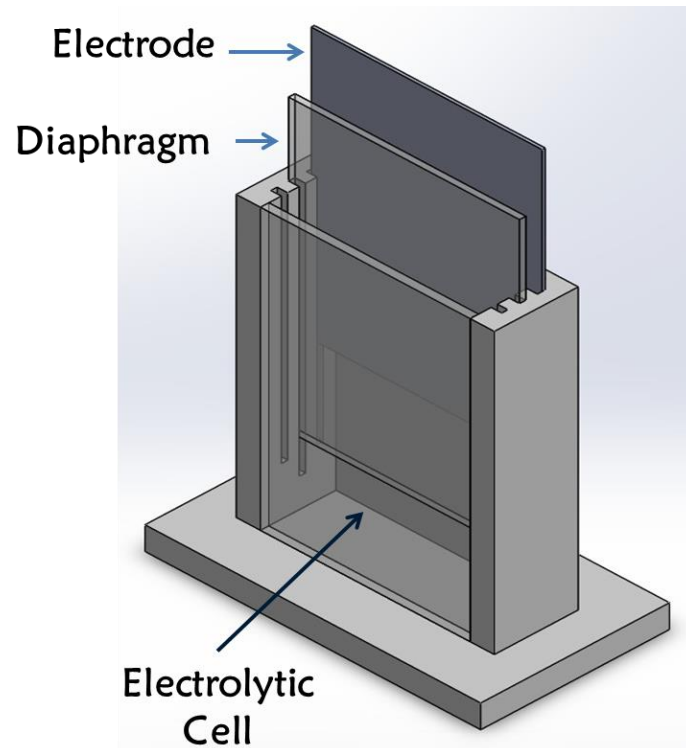
Triángulos contrapuestos

10.5455/jjee.204-1590965088

10.37394/232022.2022.2.15

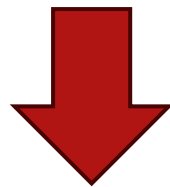
Diseño y construcción de celdas electroquímicas

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Muchas gracias por su atención

Si tiene alguna pregunta
adicional puede enviarla al
correo electrónico



mlavorante@citedef.gob.ar

