Free Hydro Cells

The Future of Green Hydrogen

Challenges and Opportunities

Thursday 16th January 2025
10.00am – 12.30pm

UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh
RWTH AACHEN UNIVERSITY
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BARDS A Sound Approach to Chemical Analysis
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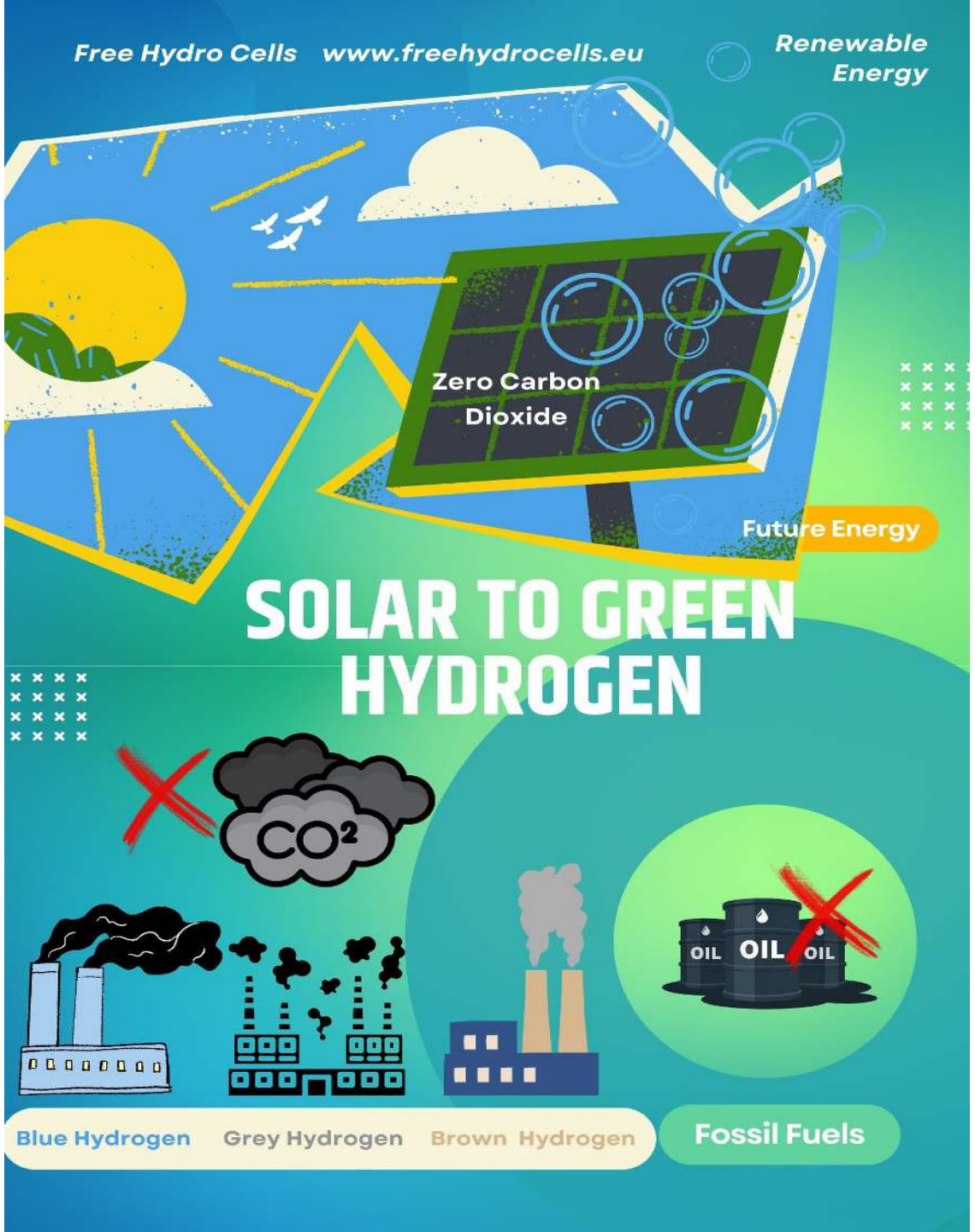
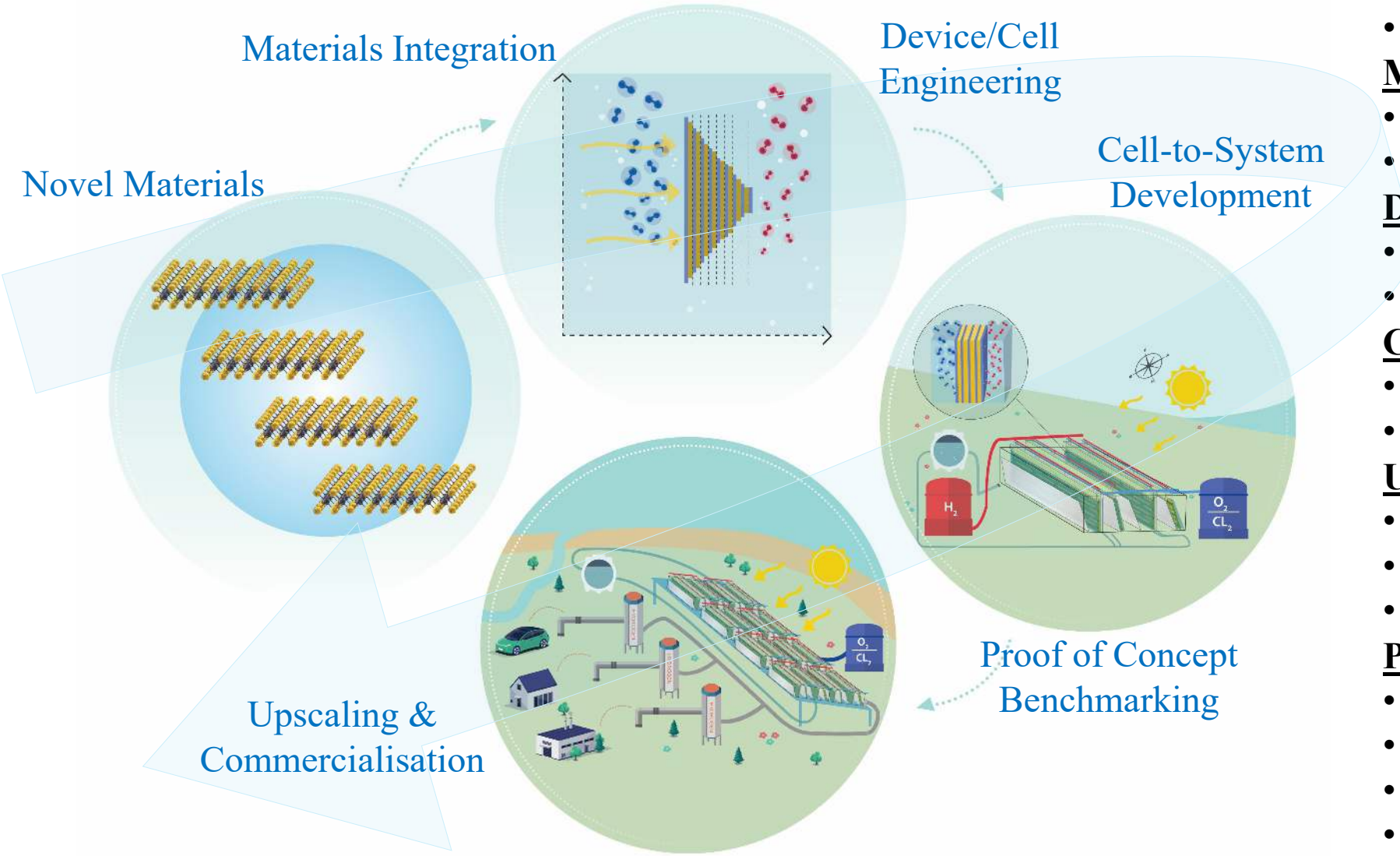
Programme

- Welcome and Introduction (30 mins)
- Sharing of Open Questions with Facilitated Breakout Sessions (45 mins)
- Feedback from Breakout Sessions (30 mins)
- Discussion and Questions (15 mins)

- **Renewable energy:** energy production that does not deplete our natural resources or pollute our environment
- **Carbon dioxide:** CO_2 is damaging to our atmosphere when it is beyond certain concentration amounts
- **Fossil fuels:** Hydrocarbon-based organic matter (e.g. coal, methane, peat, wood) burned by humans to produce energy and heat but also pollutants for our atmosphere/environment
- **Green Hydrogen:** Renewable H_2 production with no pollutant by-product, does not deplete our natural resources
- **Electrolysers:** Electrochemical systems that split water to produce H_2. Unfortunately, these systems deplete our natural resources (e.g. platinum is needed in high quantities). Green, low power, electrolysers are needed!
- **Solar-to-Green Hydrogen:** This can be solar panels driving green electrolysers to make H_2, or other green solar energy-absorbing systems to make H_2, like *FreeHydroCells*
- **Hydrogen from Wind/Water:** Wind turbines & hydroelectric dams can drive electrolysers for H_2
- **Blue/Grey Hydrogen:** Steam methane reforming (SMR) to H_2 with different levels of CO_2 pollutant release (50-90 %?)
- **Brown/Black Hydrogen:** Coal gasification to H_2 & CO_2



The *FreeHydroCells* Project



Novel Materials
- Environmentally-benign
- Cost-effective & sustainable
- Good light absorbers

Materials Integration
- Make multilayer junctions
- Max. energy retention, min. losses

Device/Cell Engineering
- Transfer energy to split water→H_2
- Photon energy to chemical energy

Cell-to-System Development
- Large volumes of H_2 needed
- System efficiency key

Upscaling & Commercialisation
- Modular expansion possible
- Good life-cycle predictions
- Commercially competitive

Proof of Concept Benchmarking
- Operationally efficient & low cost
- Viable for Green H_2 gas production
- Durable with long service life
- Green H_2 efficiency benchmark

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FreeHydroCells Concept (and its Disruptive Opportunity)

Concept: a scalable and sustainable modular system that splits water to produce green H_2 using sunlight and built with environmentally benign materials which requires zero energy input. It will be fully compatible with wind & hydro integration for 24/7 operation) – with a separate novel solution idea for locally distributed H_2 storage.

- The novelty of the tech/sys reduces the risk and €/Energy cost
- Provides a disruptive effect on policy and marketplace drivers to deploy the tech/sys for a full & rapid transition to green H_2
- Creates a significant challenge for community readiness, as effect of implementing concept would mean green H_2 production and storage locally within the community

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Challenges…

- **Policy & marketplace** drivers are mostly focused on green H_2 inclusion into hydrocarbon processing/delivery, less so for a full and rapid transition from fossil fuels to green H_2
- **Technology & systems**' solutions are focused on wind energy powering electrolysers for green H_2 production, and depleted gas fields and land caverns for H_2 storage – all tech/sys eggs in one basket (very high risk), & high €/Energy/Resource cost
- **Community readiness** is likely achievable for present plan of green H_2 inclusion with hydrocarbons, but less so for a full and rapid transition to green H_2 (feasibility increasingly in doubt, targets slipping constantly), or for paying high €/Energy cost

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...and Opportunities

- **Policy & marketplace** ready for infusion of drivers to modify present plan with greater focus on taking existing energy customers on a rapid transition from fossil fuels to green H_2
- **Technology & systems**' solutions at present too narrowly focused, which provides opportunities for emerging novel technologies and systems for green H_2 production and storage to reduce risk and to reduce the €/Energy/Resource cost
- **Community readiness** is likely not there at present for the type of disruptive effect a full and rapid transition to green H_2 would have on the community, but reducing the €/Energy cost substantially for users would be a high incentive driver

Breakout Sessions

Discussion and Questions

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Thank you

Contact us:

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www.freehydrocells.eu

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