



Rapid to deploy hydrogen vehicle refuelling: solving the chicken and egg dilemma

Dr Lee Juby CEng FIET
Commercial Director

<https://www.linkedin.com/in/drleejuby/>

THE REVOLUTION OF
HYDROGEN AS A
FUEL AT SCALE, IS
JUST STARTING

Hydrogen has
failed to deliver
until now....

Hydrogen is a great clean fuel for commercial transport

- ❏ No emissions but water
- ❏ Super fast refuelling capability (minutes, rather than hours)

What's missing? An affordable hydrogen refuelling station infrastructure network

- ❏ Up to now it's been sub-scale, expensive, and unreliable
- ❏ Regulation, financing and construction has been clunky

This is the problem NanoSUN solves for buses, forklifts, delivery vans and HGVs

Traditional approaches to hydrogen mobility

- **High** CAPEX (& OPEX)
- **Low** utilization **in early life**
- **Challenging to** back up **for resilience.**
- **High investment hurdle** for new customers/trials



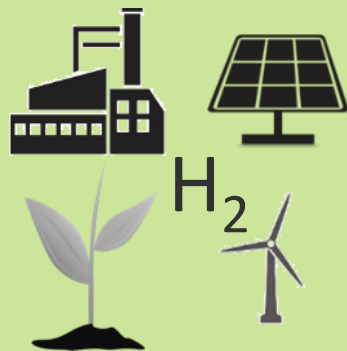
PRODUCTION

DISTRIBUTION

DISPENSING

CONSUMPTION

Hydrogen Fuel Value Chain - Problem



Hydrogen Fuel Value Chain - Reinvented



£2m - £4m



Diesel Equivalent?

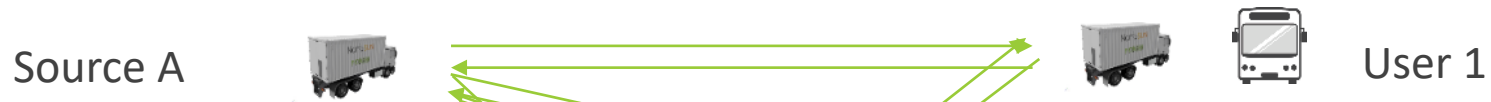


£0.6m - £1.2m



From here to there

A) Start with one source, one user



B) Add more users



C) Add more sources



D) Add more users



Building the Hydrogen Ecosystem

The Pioneer enables multiple hydrogen sources and multiple hydrogen users to establish and scale quickly.

Matching hydrogen demand and supply.

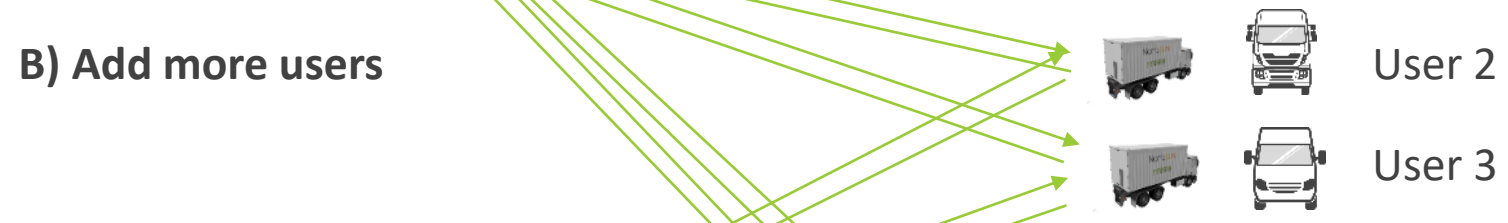


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Building the Hydrogen Ecosystem

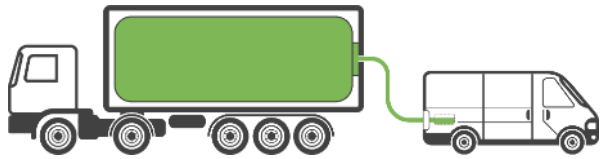
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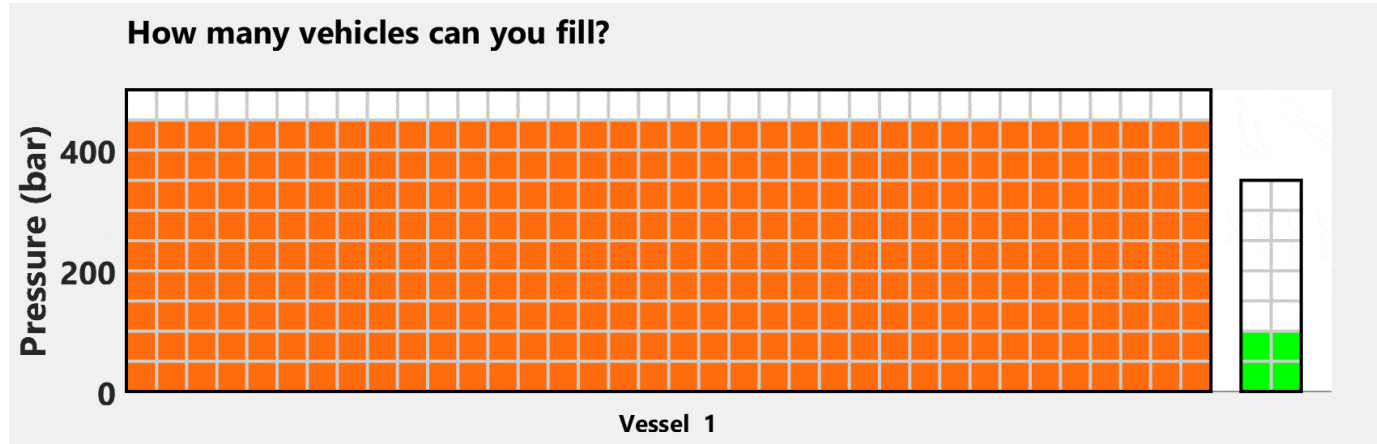
Justifying investment in large scale fixed hydrogen infrastructure that can serve a preexisting user base.



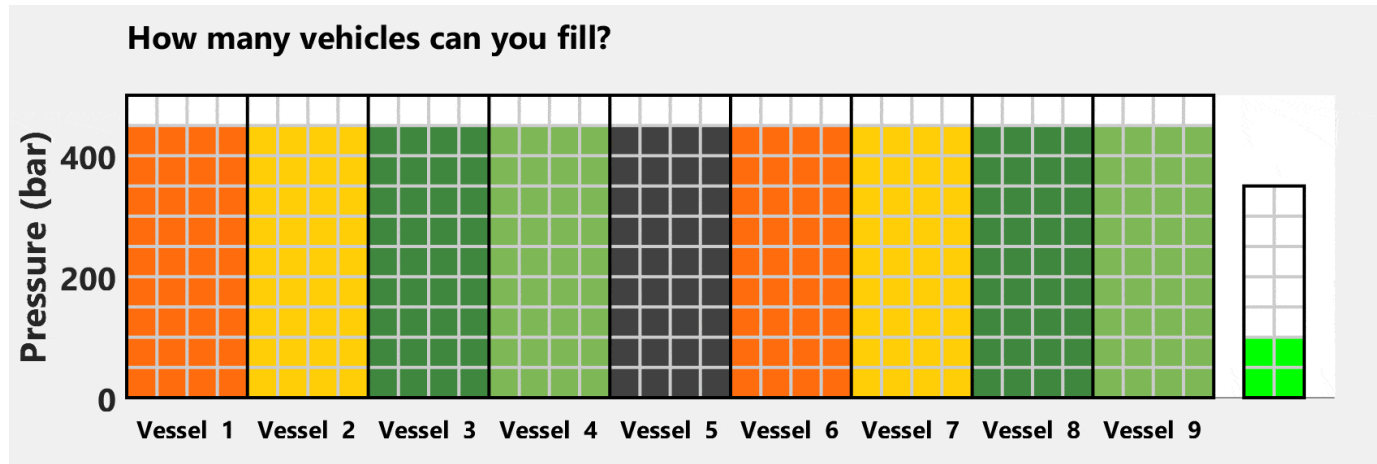
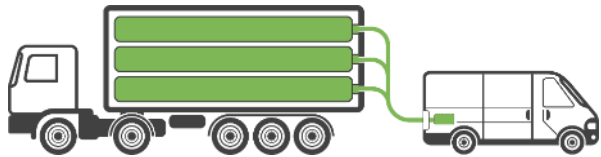
Pioneer Cascade Refueller



Decant fill
(tube trailer mode)



Cascade fill
(Individual sequential control)



Pioneer Progress

- 🔍 **NanoSUN Complete Manufacturing and Commissioning of its First Hydrogen Refueller!**
- 🔍 **Mobile HRS:** Type Approval against the Transportable Pressure Equipment Directive (TPED) and the Accord Dangereux Routier treaty (ADR),
- 🔍 **Static storage:** Type Approval against the Pressure Equipment Directive (PED).
- 🔍 **ATEX certification**



Pioneer Demonstration



- Westfalen AG
- Pioneer HRS Demo to Germany's Federal Ministry of Transport & Minister of State
- Pioneer Operation at IAA mobility refuelling show shuttle bus
- www.nanosun.co.uk/pioneer/pioneer-journey



Pioneer Demonstration



- 📍 **INEOS, Wrightbus, Ryze Hydrogen**
- 📍 Refuelling the Wightbus on 'The UK Hydrogen Roadshow'
- 📍 09:00 21/10/2021
 - First fill. Lancaster England.
- 📍 15:30 21/10/2021
 - Second fill. Gretna Green, Scotland.
- 📍 One Pioneer. Two Locations. One Day.
- 📍 www.ukhydrogenroadshow.com



Pioneer Demonstration



- ❏ **Glasgow City Council**
- ❏ Deployment to support the dual fuel gritter lorries and the hydrogen refuse collection vehicles
- ❏ Pioneer is the interim solution while a fix refuelling station is constructed
- ❏ Refuelling demonstrated during COP26



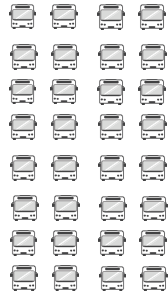
A HUGE OPPORTUNITY

Pioneer Solution

Demo Fleets

Small to Medium Fleets

Large Fleets

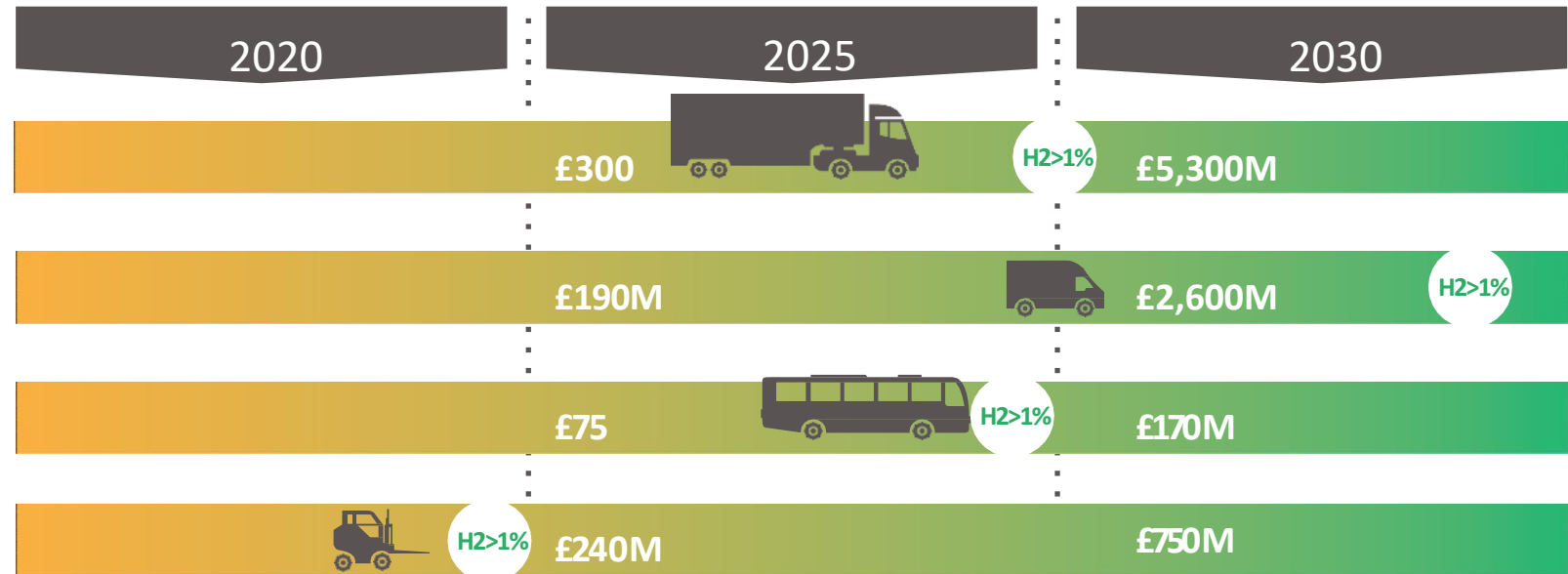


High CAPEX fixed filling stations

Small scale compressor based solutions



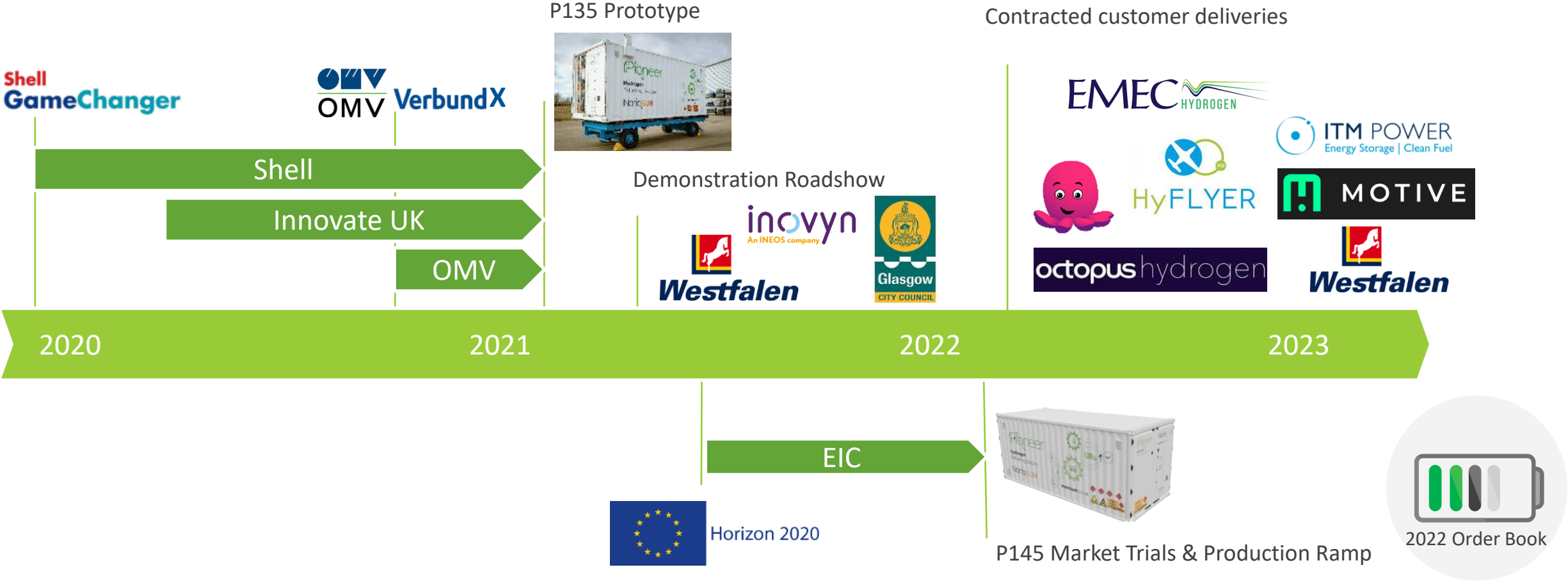
£800M in UK/EU markets by 2025 - and could grow 10x by 2030, in these segments



Just a 1% increase in H2 penetration = >£5Bn SAM for just the EU market.

Commercialisation Approach

Scaling proven cascade refuelling technology to heavy transport applications



Pioneer Mobile Hydrogen Refuelling Station

info@nanosun.co.uk

