

**PART OF  
A BETTER  
FUTURE**



# **NEW ENERGY SCREENING TOOL**

2022 Digital Forum

Marc Senders | 21 September 2022

## INTRODUCTION

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## OVERVIEW

# We are Woodside

- We are a global energy company, proudly Australian with a spirit of innovation and determination.
- We provide energy that the world needs to heat homes, keep lights on and support industry.
- We aim to thrive through the global energy transition with a low-cost, lower-carbon, profitable, resilient and diversified portfolio.

## OUR FOCUS

**PROVIDE LOW-COST, LOWER-CARBON  
ENERGY THE WORLD NEEDS**

**Our resilient and diversified portfolio  
will help us thrive through the global  
energy transition.**

### **World-class assets**

Our focus is the safety, reliability, efficiency and environmental performance of our operations, leveraging more than 35 years of experience.

### **Delivering growth**

We have growth opportunities across our three pillars of oil, gas and new energy.

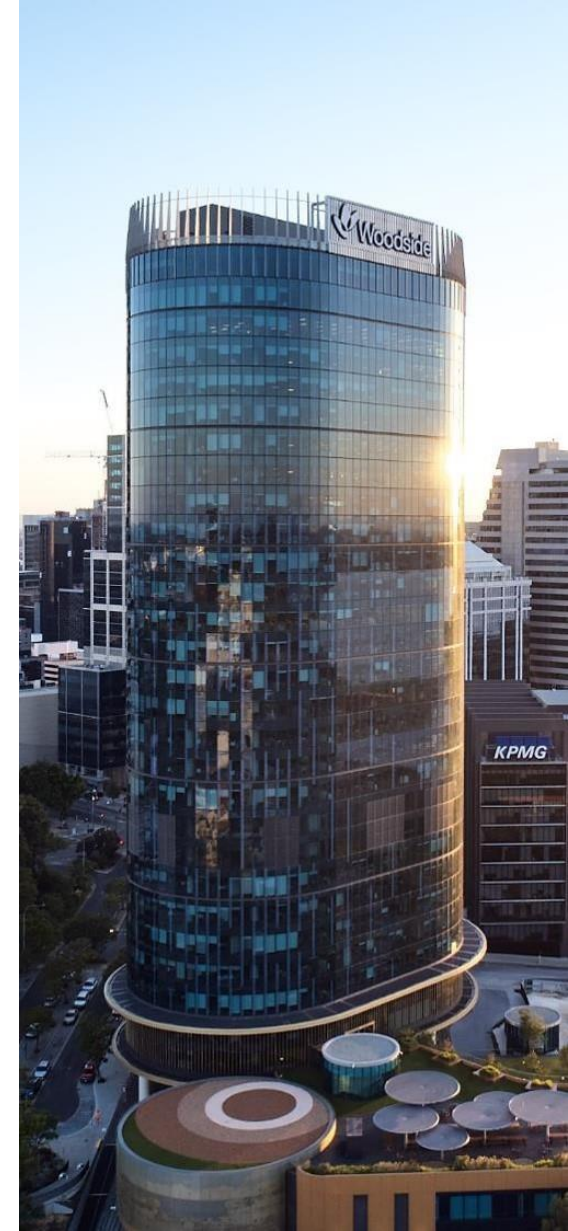
### **Social and economic benefits**

Environmental, social and governance performance is integral to our success.

### **New energy**

We are targeting to invest US\$5 billion in new energy products and lower-carbon services by 2030<sup>1</sup>.

1. Targeted investment in new energy products and lower-carbon services by 2030. Individual investment decisions are subject to Woodside's investment hurdles. Not guidance.



## Woodside – Schlumberger Collaboration

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**LONDON, August 20, 2019**—*“Schlumberger announced today an enterprise-wide deployment of the DELFI\* cognitive E&P environment through a seven-year technology collaboration with Woodside Energy. Woodside will leverage this secure cloud-based software environment to increase consistency, reduce study cycle time and foster innovation in its subsurface characterization and development activities.”*



# NEST

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New Energy Screening Tool

# The objective

**End-to-end right sizing**

Of all components

**Optimise**  
all components

**Sensitivities**  
across all items



## What-if?

(scaling, concepts, cost evolution)



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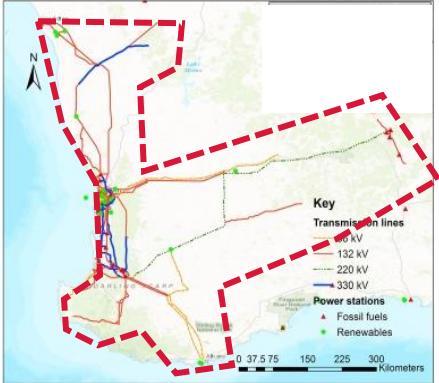
# What are our system constraints?

- Customer location
- Delivery / electrolyser location for shipping
- Area of interest for wind
- Existing electricity network
- Land utilisation / availability in the Area of Interest

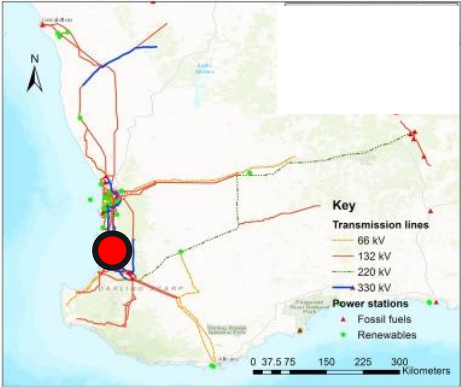
### Hydrogen Demand



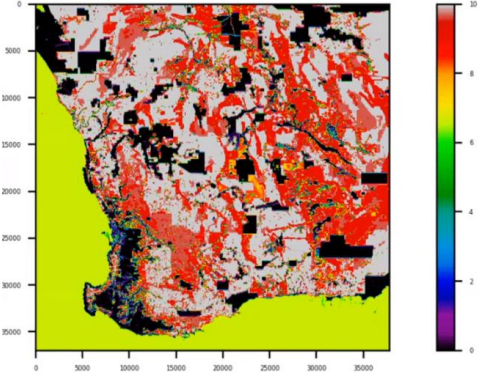
### Area of Interest



### Electrolyser Location



### Spatial constraint rasters



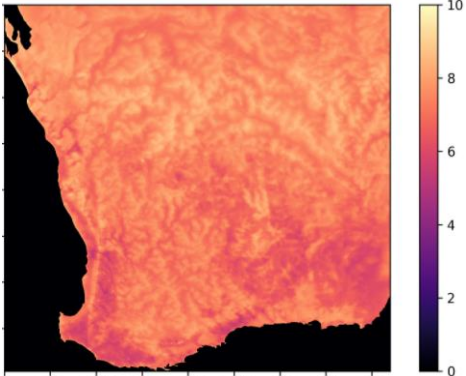
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What data do we need to work with?

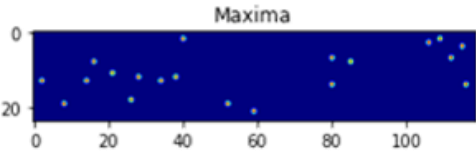
Wind data

- Needs to be enriched
- Interpolated
- Annualised
- Want high potential annual average wind speeds

From very high resolution spatial data



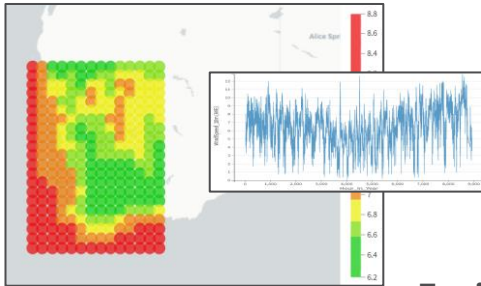
Find local wind power maxima



1000s of local maxima

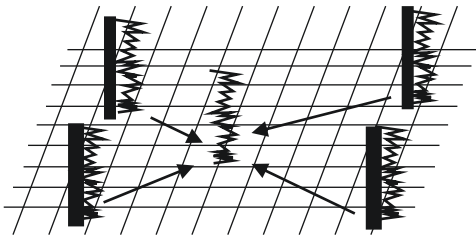
High spatial resolution (low temporal) wind data

Streamed in data  
Wind models  
MERRA (NASA)

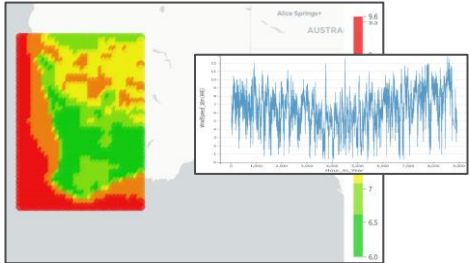


Enrich the data

High resolution temporal data



ERRA5 (EU / ESA)



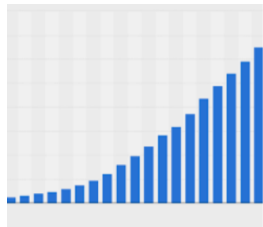


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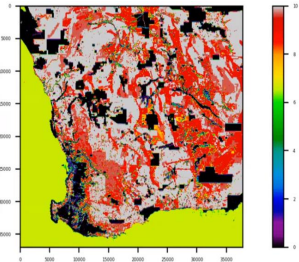
# The solution: Optimise for power, time and distance from infrastructure

Optimise to:

- Maximise annualised wind power
- Minimise distance to nearest transmission line
- Minimise annualised grid power cost
- Minimise transport losses

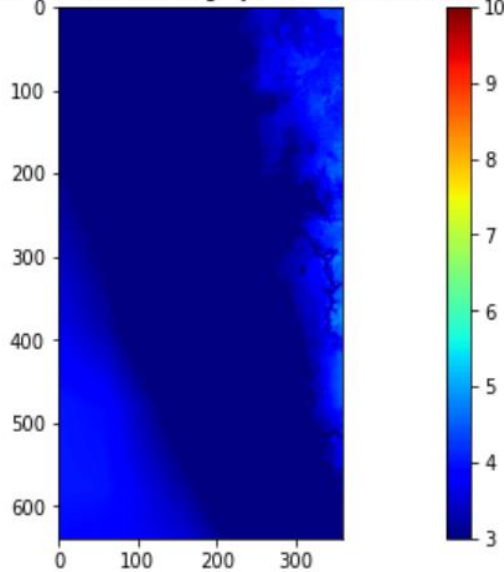


Highest Power Potential

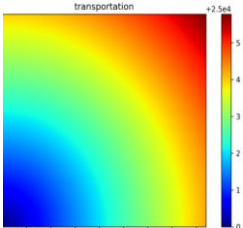


Spatial Raster Ranking

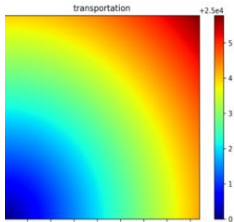
Wind speed (m/s) - Hour through year = 314. WA time = 10



Wind Variability



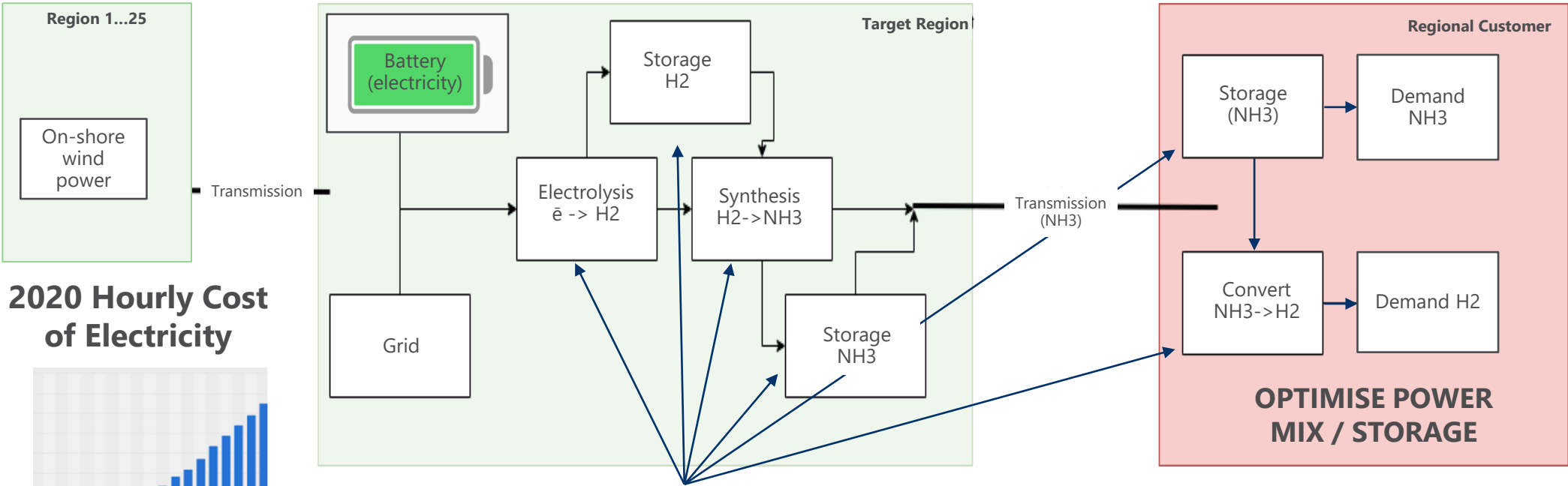
Distance to nearest Transmission Line



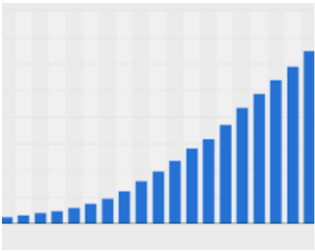
Distance to Perth

# The solution: Optimise entire system for Levelized Cost Of Electricity (LCOE)

Optimise to find best performance of integrated electrolyser + grid + battery + wind farm sites

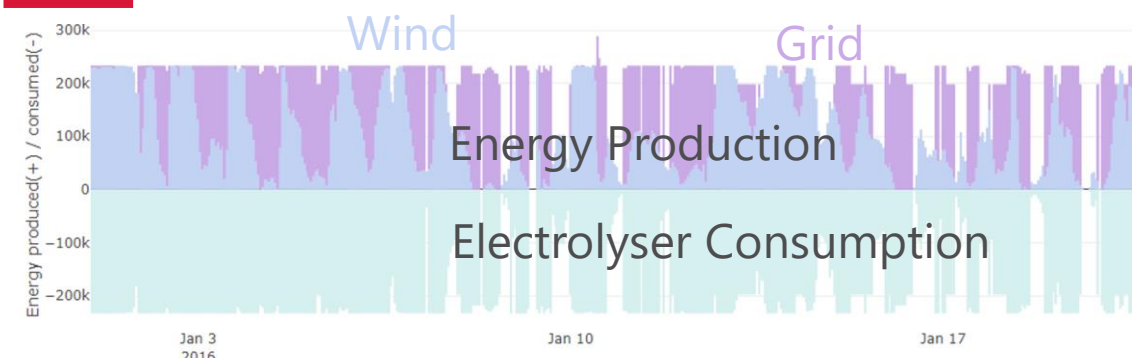


2020 Hourly Cost of Electricity



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### Results – location and cost of supply



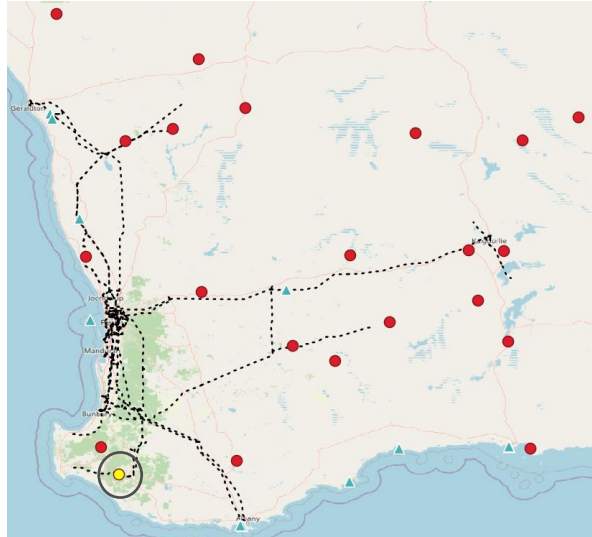
'simulation and optimisation' workflow

## RESULTS



GENERATION	ELECTROLYSER	DELIVERED
Wind Sites <b>1</b>	LCOE <b>\$31.6/MWh</b>	Japan / South Korea LCOH <b>\$3.7/k g</b>
Capacity <b>1.1 GW</b>	LCOH <b>\$2.47/k g</b>	LCOA <b>\$644.2/ton</b>
Grid Usage <b>6%</b>	Capacity <b>630 MW</b>	
Annual Generation <b>3.9 TWh</b>		

*Example only - not indicative price/cost information*







## REAL CASES

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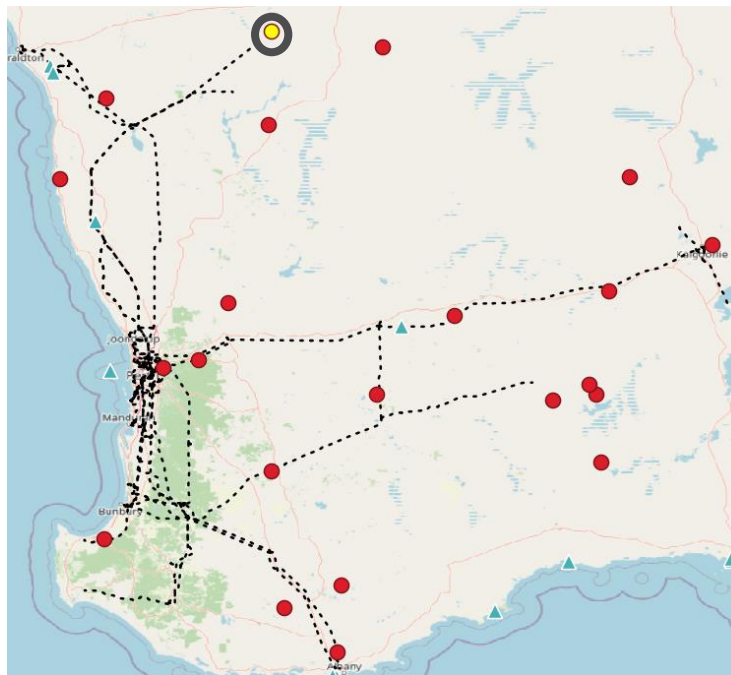
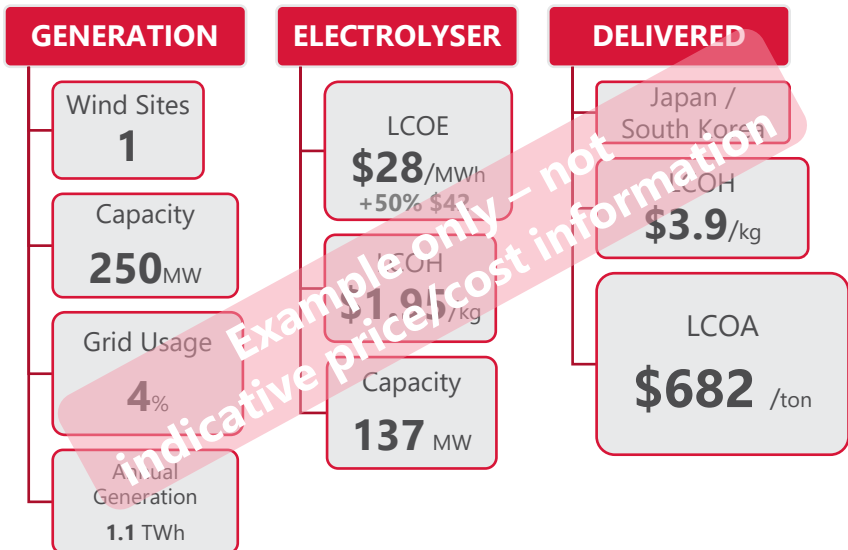
Allowing the system to search for the lowest cost configuration

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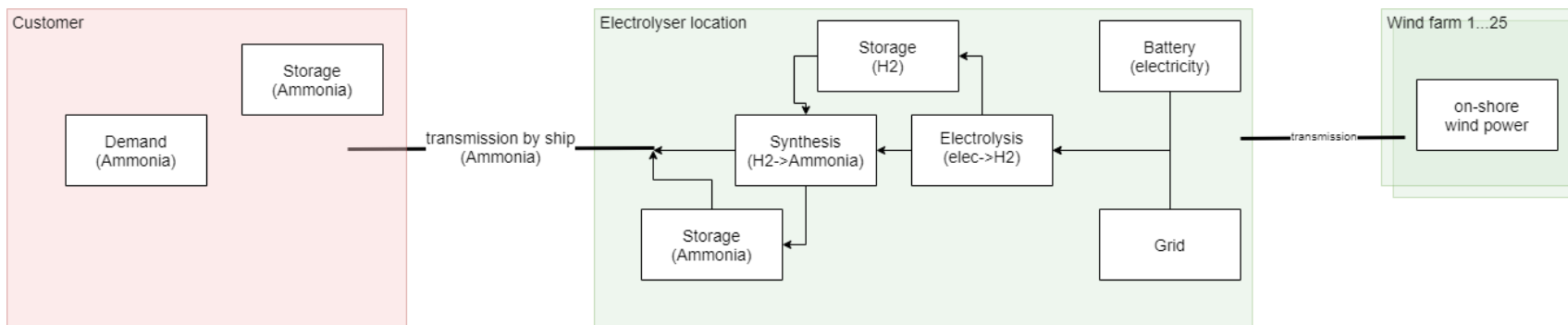


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## Medium Ammonia / Year (30X)

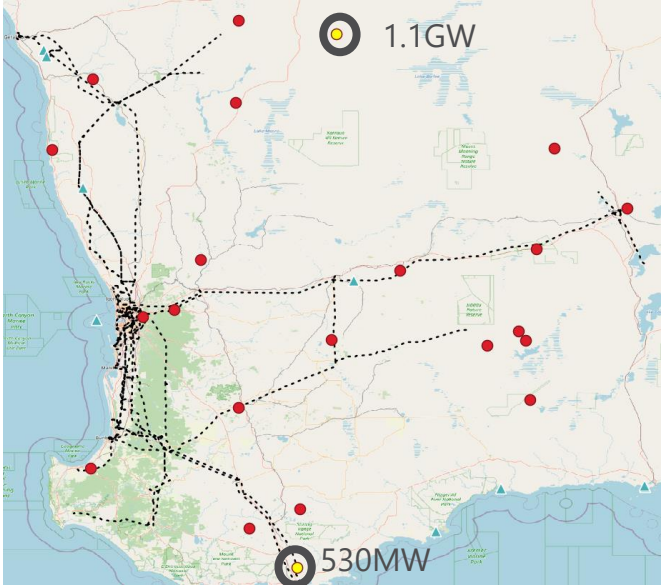
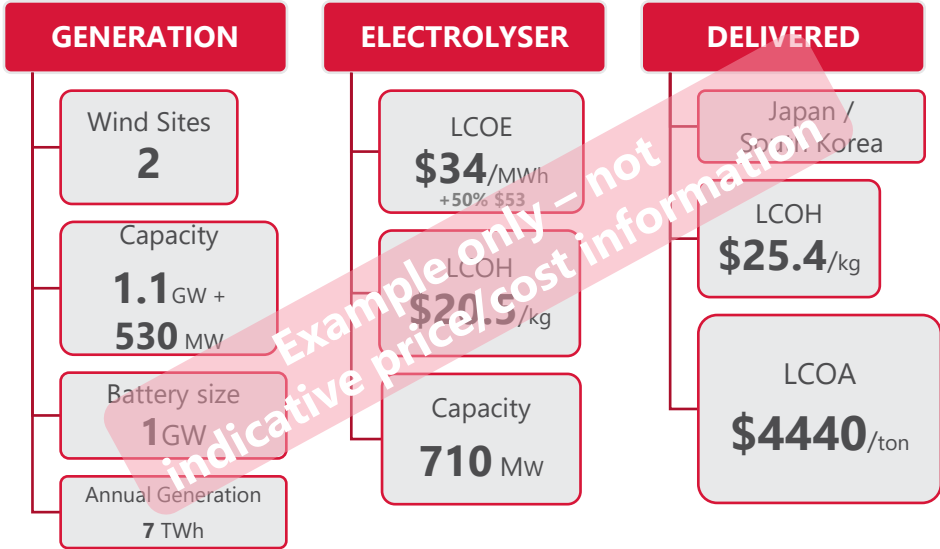


- Economies of scale
- LCOE drops (-12.5%)
- Delivered costs falling (-19.5%)



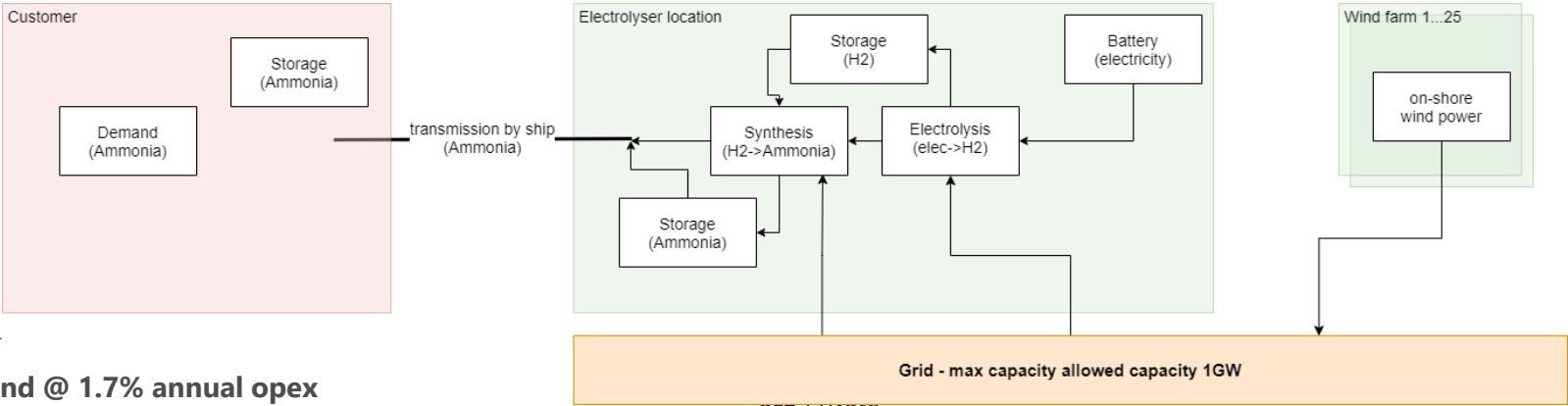
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Large Ammonia / Year (10X) – 1GW grid capacity constraint



- Transmission grid capacity limits scale up
- Forced to use battery storage to meet demand
- Huge spike in costs

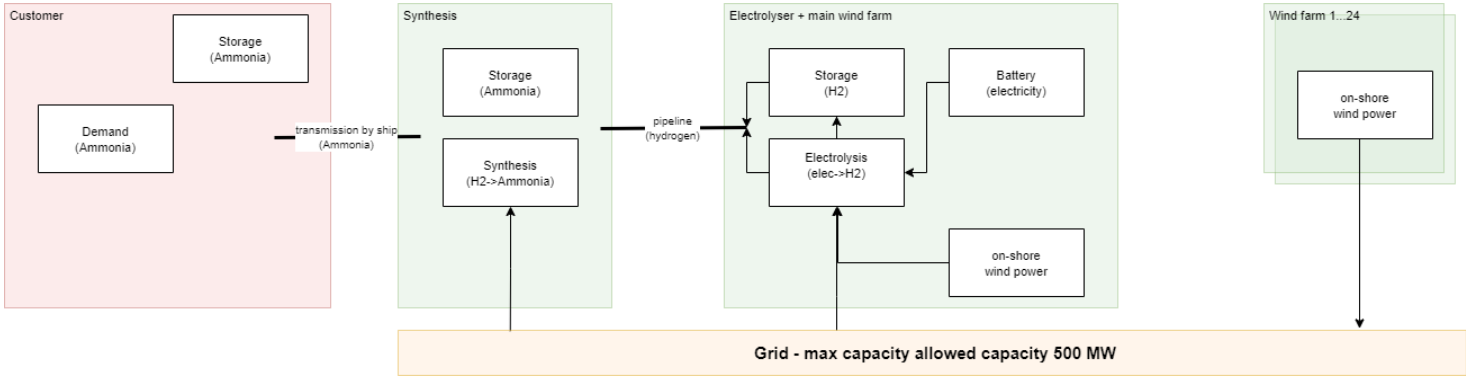
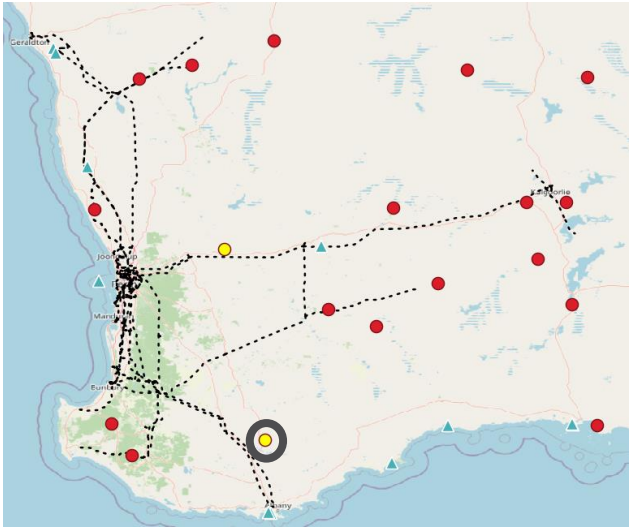
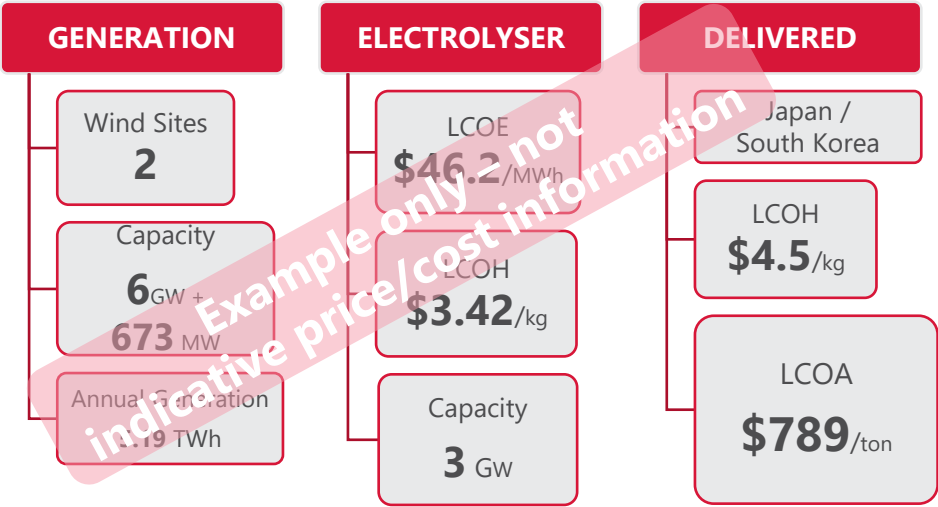
Optimiser added a battery to try and meet demand but it still ends up with some unmet demand





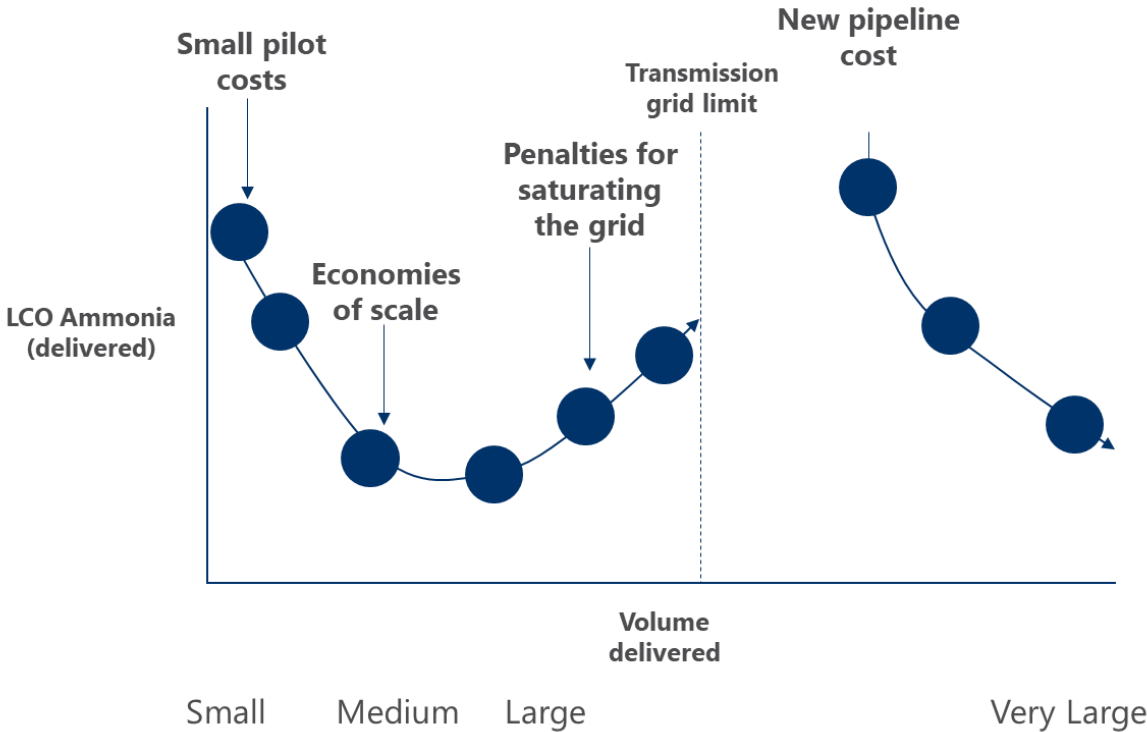
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Very large Ammonia Year – Pipeline cases



# Insights

- Small pilot scale projects are expensive.
- Lowest cost of Ammonia is achieved at 100s of kilotons per year.
- Once transmission grid limit is reached, producing ammonia at site and transporting via pipeline becomes preferable



# Summary



**Flexible & powerful**  
solution that can provide  
rapid insights

Automate full analysis and  
**update easily** (in minutes)

**Economic sensitivity** across  
the full end-to-end workflow

Apply to any **global** location

**Extendable** to all other main  
energy use cases (eg Solar)



## The Team





# ADDENDUM



H2Perth

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# H2Perth: making WA a hydrogen powerhouse



Proposal for a world-scale hydrogen and ammonia production facility



Phased development: First phase focused on lower-carbon, low-cost and early hydrogen: 65 TJ/day natural gas and up to 250 MW electrolysis



Project designed to abate, store and/or offset all emissions associated with the production of hydrogen and ammonia



Later expansion to be driven by additional renewable energy developments



More than hydrogen - provides stable demand to support grid stability as renewables increase



H2Perth schematic. Conceptual only, not to scale.



Close

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Thankyou for your attention

