
# gravitricity

Fast, Long life Energy Storage

# Keeping the lights on

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## Gravitricity exists to enable the transition to zero-carbon energy


Renewables

Nuclear

Electrification

Full Energy system transition

Massively increasing flexibility required, including grid-scale storage

# USPs

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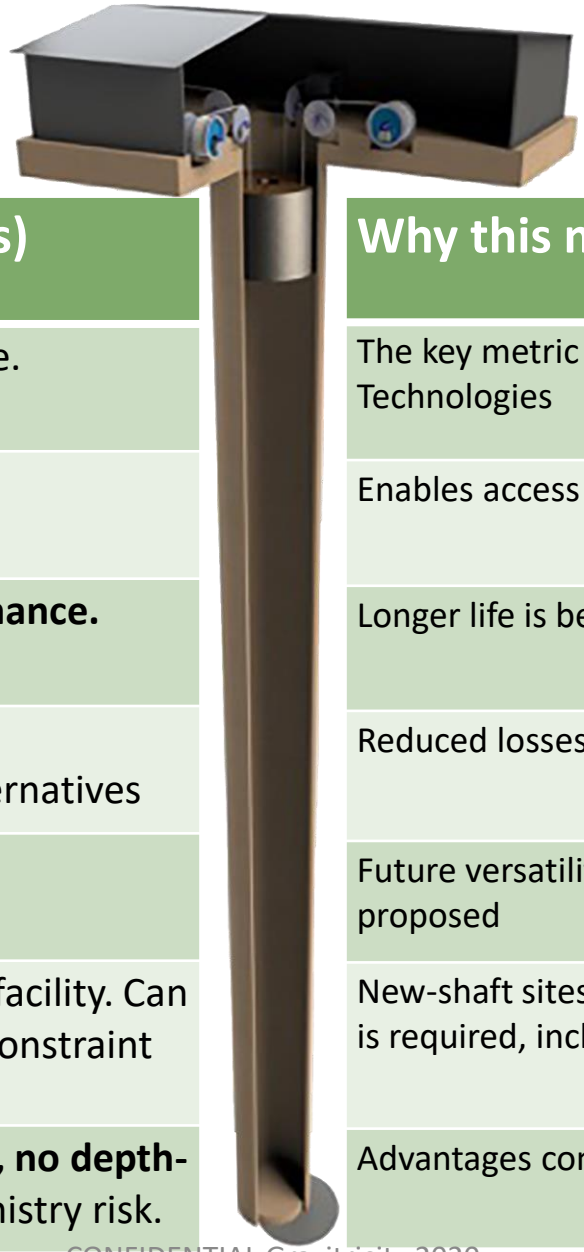

| Technical Characteristics (USPs) | Why this matters |
|---|---|
| **Low levelised (lifetime) cost** of storage. | The key metric for comparing Energy Storage Technologies |
| **Rapid response**: Full rated power <1s | Enables access to higher value revenue streams |
| **Long cycle life with no loss of performance.** (75,000+ cycles) | Longer life is better value for customers |
| **High efficiency:** 80-90%. As good or better than all alternatives | Reduced losses means more usable power |
| **Versatile Power/Energy ratio**: 15 min to 4 hour output. | Future versatility is essential. Modular system proposed |
| **Small footprint**: <30mx30m for 8MW facility. Can be sunk below ground. No locational constraint at new-shaft sites. | New-shaft sites can be deployed exactly where storage is required, including urban sites. |
| **No parasitic loads, no standing losses, no depth-of-discharge limits**. No explosive chemistry risk. | Advantages compared to chemical batteries |

# USPs

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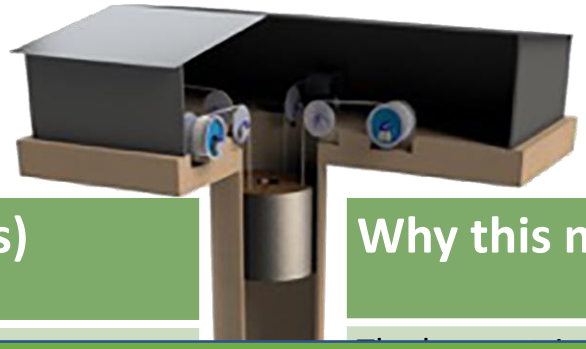


| Technical Characteristics (USPs) | Why this matters |
|---|---|
| **Lo** | |
| **R**<br>Fu | |
| **Lo**<br>(7 | |
| **H**<br>80 | |
| **V**<br>15 | |
| **Sr**<br>bo<br>at | |
| **N**<br>**of-discharge limits**. No explosive chemistry risk. | |

FAST (<1s)

DURABLE (75,000+ cycles)

COST EFFECTIVE (LCOS <$150/MWh)

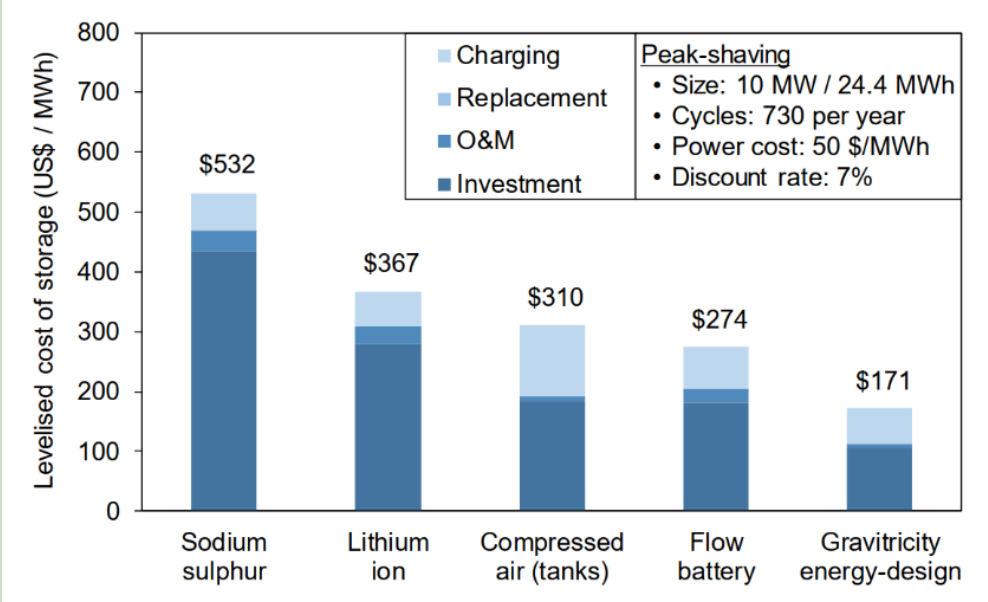
# Competition (LCOS)

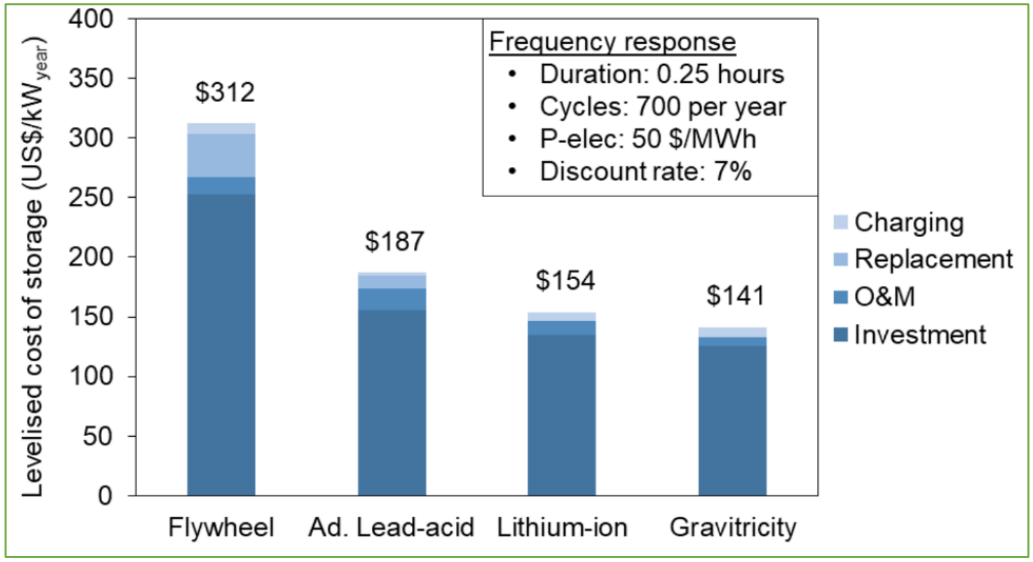
## ENERGY

Gravitricity multiple weight system designed for an output duration of 2.5-hours.

Graph shows the levelised cost of energy-designed Gravitricity systems and four other technologies for **peak shaving** applications.

Ref: Report *Levelised Cost of Storage for energy-designed Gravitricity storage systems,* O Schmidt, Imperial College. July 2019.




## POWER

Gravitricity single weight system designed for an output duration of 15-minutes

Graph shows the levelized cost of power-designed Gravitricity systems and three other technologies for **frequency response** applications.

Ref: Report *Levelised Cost of Storage for Gravitricity Storage Systems,* O Schmidt, Imperial College. March 2018.

# R&D Plan


**250kW Concept Demonstrator Model**
**Currently being manufactured**

## 2020

**Concept Demonstrator 250kW**

- Validation of dynamic simulations
- Proof of commercial characteristics

## 2021-23

**Full scale prototype 4-8MW**

- Full system integration (multiple modules)
- Proof of commercial operation via an aggregator

## 2023 -

**Mineshaft Projects**

- Turnkey equipment sales/leasing
- Licensing

**New Shaft Projects**

- R&D from 2020
- Projects from 2025

# Team

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## Our Founders

**Peter Fraenkel**
Technical Director

**Martin Wright**
Chairman

**Charlie Blair**
Managing Director

Gravitricity's core team has 70+ years experience in renewable energy. **Peter Fraenkel** (Technical Director) and **Martin Wright** (Chairman) founded and grew Marine Current Turbines (MCT), the world's most successful tidal stream energy company. MCT was sold to Siemens in 2012. Before that Peter was a founder of IT Power and Martin a Navy Officer and Venture Capitalist. **Charlie Blair** (Managing Director) has worked in energy technology innovation for 15 years and has supported over 20 energy technology start-ups. He joined Gravitricity having been Head of Marine Energy at the Carbon Trust and an associate at Carbon Limiting Technologies.

## Internal Team

Lead Engineer **Miles Franklin** joined from Dyson Engineering in 2016. Financial Director **Edmund Papworth** joined in late 2018, with Chief Technical Advisor **Richard Montague** starting in January 2019.

The team grew significantly in late 2019 and early 2020.

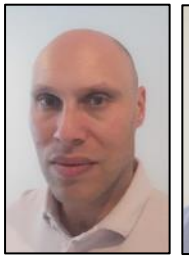
**Miles Franklin**
Lead Engineer

**Edmund Papworth**
Finance Director (Part time)

**Richard Montague**
Chief Technical Advisor (Part time)

**Chris Yendell**
Project Manager

**Ruth Apps**
Business Development Manager



**Alex Stallman**
Engineering Programme Manager

**Steven Kirk**
Senior Mechanical Engineer

**Julie Le Négaret**
Mechanical Engineer

## External Support

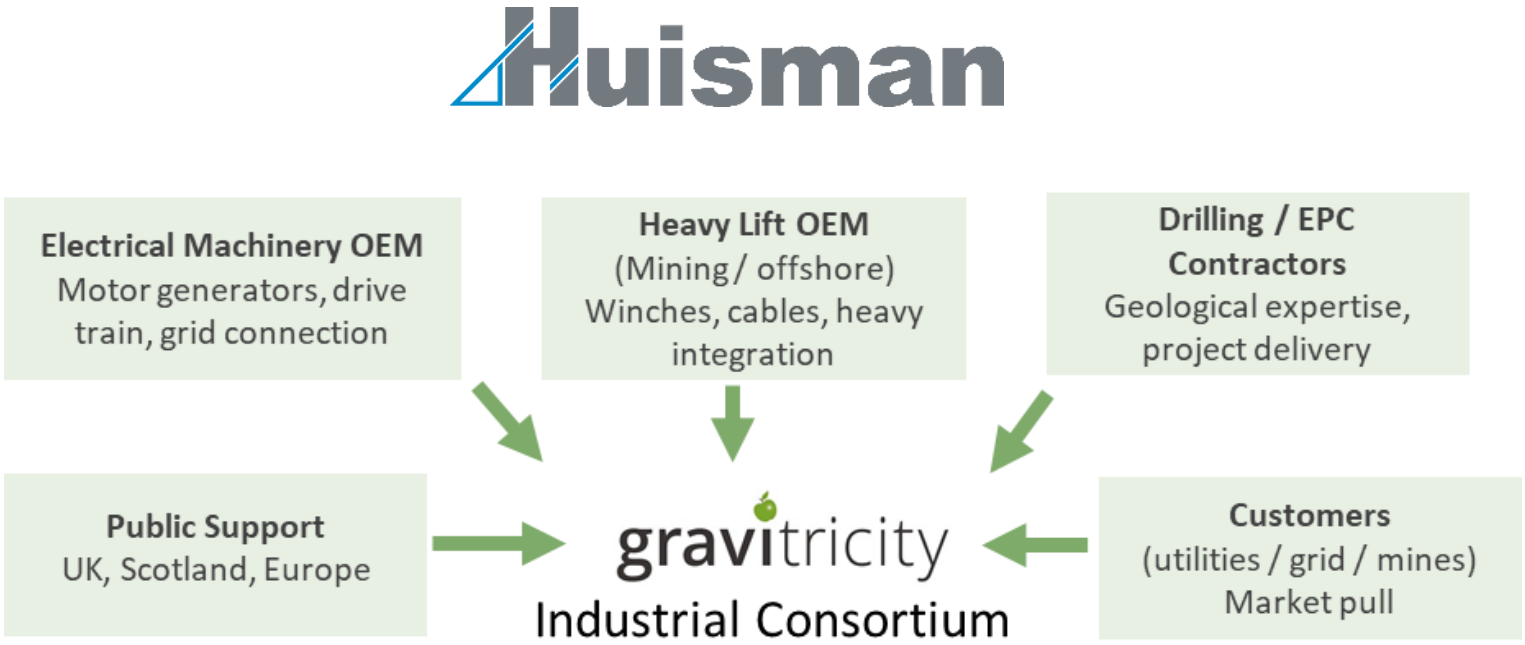
External support is provided by specialist consultants and individual experts including: Shaft sinking and geology experts **Robert Goodden** and **John Gleadowe,** intellectual property advisor **Lorne Byatt,** patent attorney **Michael Ellis** and Huisman Equipment BV's Product Manager **Cees Van Veluw** who leads the Huisman-Gravitricity engineering collaboration.

Huisman

**Wardell Armstrong** also provide specialist mine remediation and civil engineering consultancy support on existing-shaft project development and feasibility. In South Africa we are working with RESA and Caelulum (Max Carcas) to develop sites.
Gravitricity also has working relationships with a number of universities.

THE UNIVERSITY of EDINBURGH
UNIVERSITY of STRATHCLYDE POWER NETWORKS DEMONSTRATION CENTRE
THE UNIVERSITY OF QUEENSLAND AUSTRALIA
Imperial College London

# Industrial Consortium




Gravitricity's consortium is centred around winch technology partner **Huisman Equipment BV**. Huisman are global lifting, drilling and subsea specialists and manufacture specialist cranes and handling systems from bases in the Netherlands, Eastern Europe, Brazil and China.

The Consortium will grow to include other OEM manufacturers and customers including **power companies** and **mining companies.**

# Early Market - mines

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Ie Lazy Mine, Czech Republic

# Later Market – new shafts

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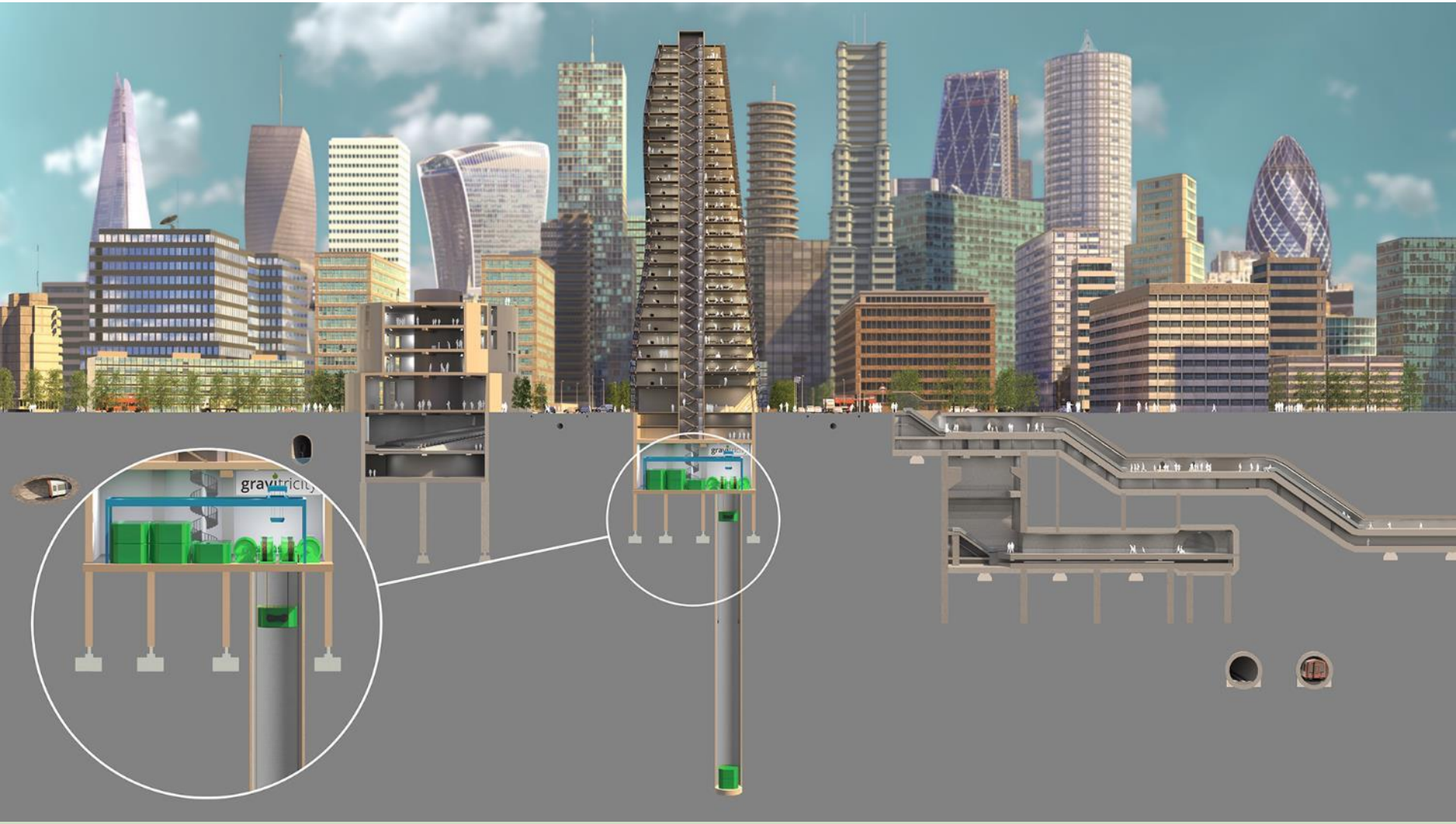

Wherever long-life storage is required

# Thankyou - Questions

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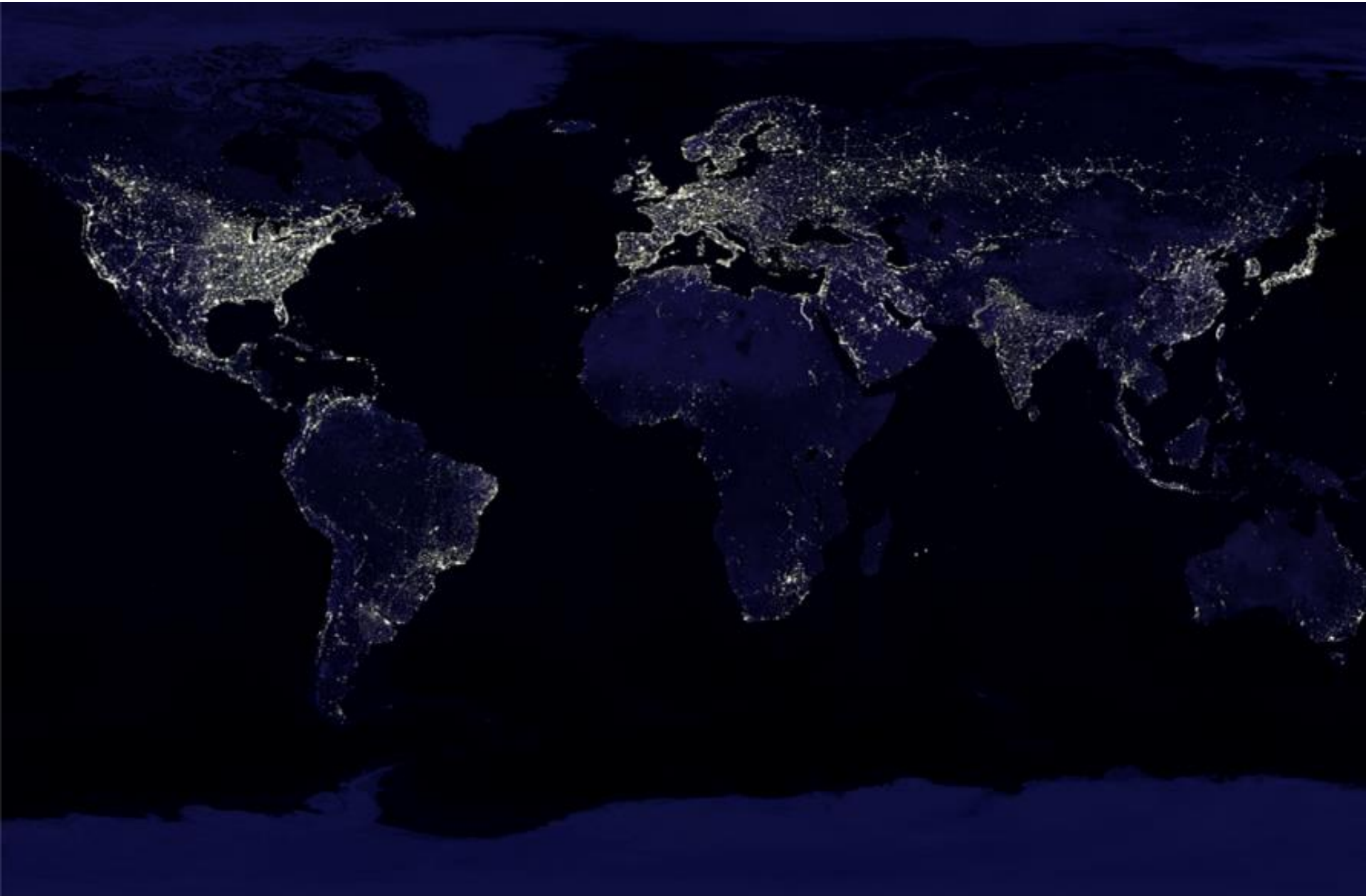

# Thankyou - Questions

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