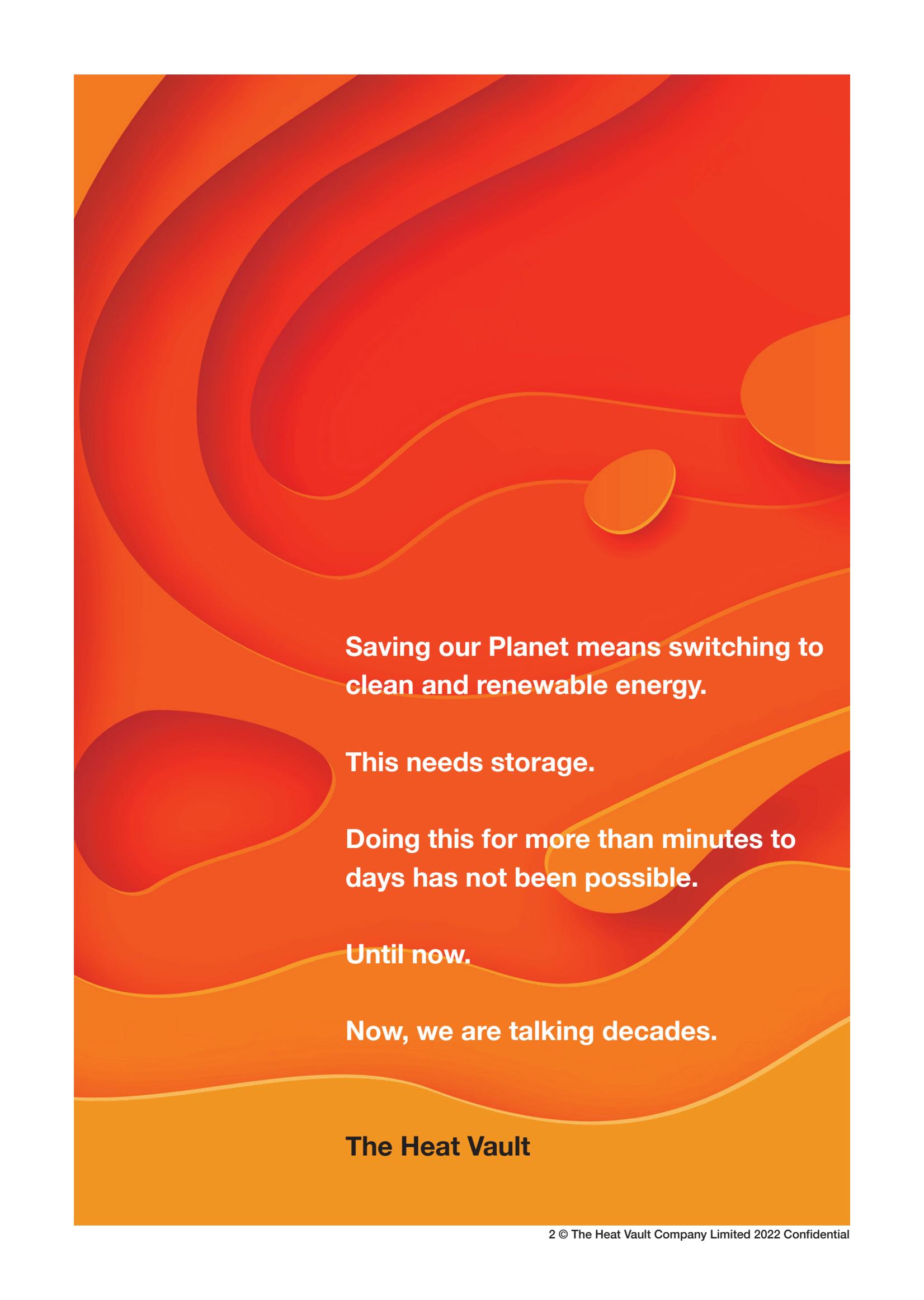




**THE
HEAT
VAULT**

SECURING ENERGY
NATURALLY



Saving our Planet means switching to clean and renewable energy.

This needs storage.

Doing this for more than minutes to days has not been possible.

Until now.

Now, we are talking decades.

The Heat Vault

Our renewable future predominantly depends on solar and wind deployment.

Both produce electricity which can only be dispatched if there's instant demand.

When demand is low, dispatch can't happen.

When demand is high, dispatch may not be enough.

Nothing gets dispatched when the sun doesn't shine and the wind doesn't blow.

Or when renewables generate excess energy.

And when summers are hot or winters are harsh, renewables can't cope.

We need an ability to store energy at large scale for long periods.

Big stores of electricity won't work and won't last.

Bigger stores of heat will.

To tackle global climate change, many nations plan to transition from a hydrocarbon economy to one led by renewable energy sources. Most leading economies propose to adopt solar and wind developments at scale. These could account for more than 60% of the energy mix by 2050.

Such a transformation can only be achieved if the severe issues of under-production or excess supply from solar and wind technologies are managed. Evidence indicates that their intermittency cannot be resolved by building such technologies at overcapacity or by massive investment in power grid transmission and distribution networks.

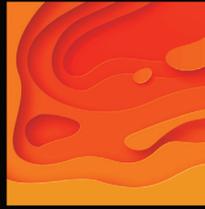
Solar and wind are non-dispatchable and unable to manage fluctuating demand. The storing of energy for use at times when they overproduce or they cannot satisfy demand would be a major advance and stimulate further renewables growth. To make a difference in energy transition at national scale, such storage has to be sizeable and able to secure and use energy for months to years.

No existing technology can achieve this. Batteries store electricity for minutes to hours. Both battery and hydrogen storage are costly, small scale, short term and wholly dependent on manufactured technology using scarce chemical elements supplied by a few countries, some of which are ethically and practically problematic.

In many countries, more than half of energy use by households and industry is in the form of heat. By contrast, electricity is less than 20%. The scale of heat demand is huge. And yet, much heat from various industries, buildings and renewables is wasted.

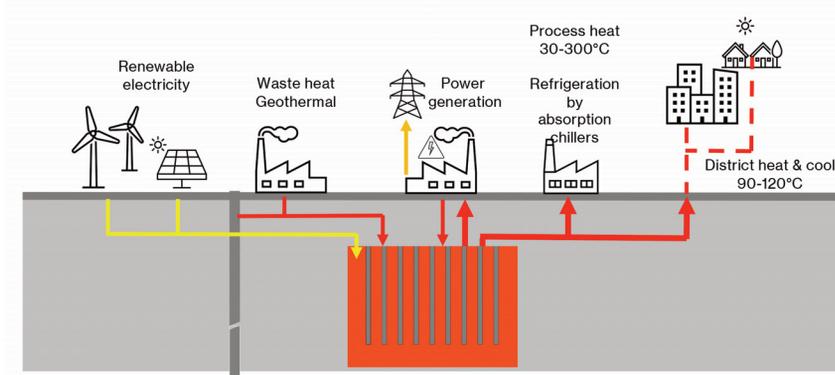
This brief document summarises the opportunity for ultra long duration energy storage not as electricity, but as heat.

The Heat Economy is vast in scale and scope.



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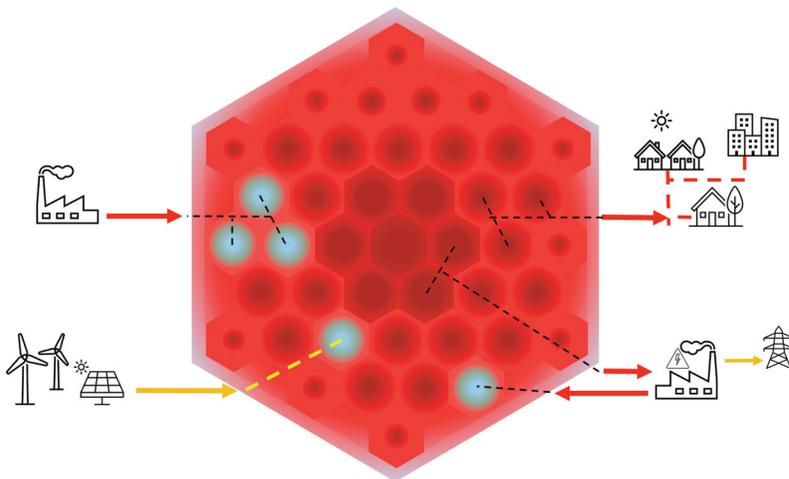


The Heat Vault is a large, utility-scale store of thermal energy which is custom designed and built into natural rocks beneath selected sites.

It can be used for short or ultra-long duration energy storage in the form of heat and recovered as heat (or cooling), electricity or hydrogen dependent on requirements.

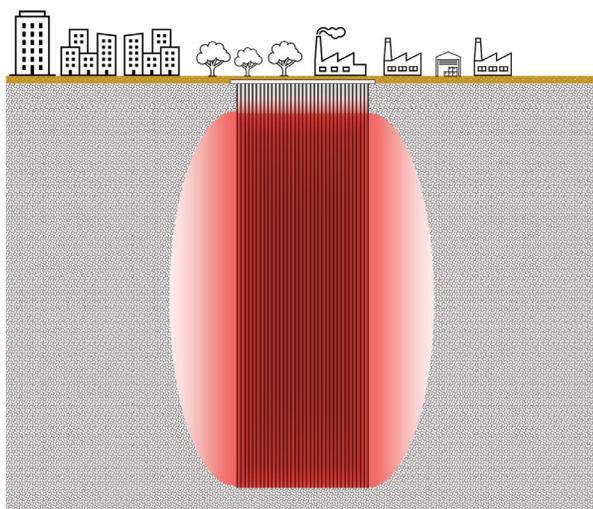
Multiple sources of waste heat and low cost excess electricity. Multiple outputs

Heat Vault stores gigawatt to terawatt hours of thermal energy for months to decades in a beehive structure within an architecture of deep boreholes.



Plan view. Yellow arrows electricity. Red arrows heat

One type of borehole can take in heat in circulating fluids in closed pipe systems. Reversing this process allows heat extraction. Another type takes in electricity to heat its surrounding rocks to high temperature, often in the range 120°C to 500°C.



Cross section. Roughly to scale

Different configurations of Heat Vault can serve as peaker plants to satisfy short, one month high demand for heat; as baseload plants to allow continuous withdrawal of heat over a four month winter season; or as combined heat and power plant for heat and electricity all year round. Smaller Heat Vault configurations can serve multiple housing requirements or commercial facilities.



The Heat Vault can:

- mitigate the intermittency of renewable sources;
- allow efficient management of heating networks in their ability to source low cost energy in low demand seasons and offer this energy to customers during peak demand in the winter season;
- act as an energy trading hub purchasing off-peak electricity and sourcing low cost waste heat for future onsale;
- be directly coupled to either a national grid system, microgrid or individual renewable assets to source energy;
- be coupled with mid-level or deeper geothermal wells to act as their heat store;
- be both a user of low grade industrial heat and a supplier of low or high grade heat to industry bilaterally or multilaterally;
- be configured as a district heating asset for use with multiple residential or commercial buildings for heating, cooling and/or electricity;
- act as an all year round and large scale backup system for heat or power, 24/7, 365 days a year, which is independent of weather conditions or resources supply.



The Heat Vault Mini Command Centre placed, for example, in a supermarket car park, can also be used for retail, café, drive-in movie screen and other functions while providing energy to retail and the surrounding community from the underground Heat Vault which is beneath an area of 30X30 metres, storing 10 GWh and costing around £4 million. This could serve a few thousand houses.

In terms of energy storage, McKinsey estimates a \$3 trillion market opportunity. Most of this is storage in short-term backup systems. But the opportunity for energy storage as heat is much greater, for broader applications and for dramatically longer periods.

The Heat Vault Company proposes to partner with organisations to provide heat utility solutions and will use project finance for rapid expansion of a network of Heat Vaults in priority countries.

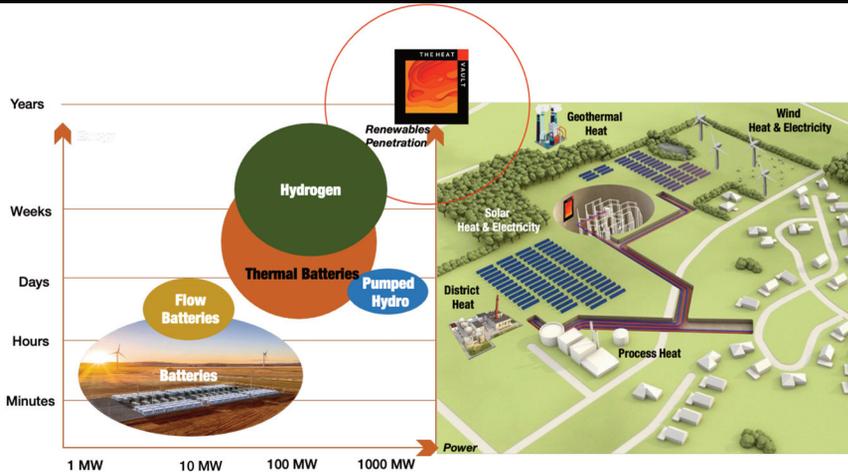
The business plan for The Heat Vault Company is available upon exchange of a Confidentiality Agreement.

Requests should be sent to info@theheatvaultcompany.com



THE HEAT VAULT

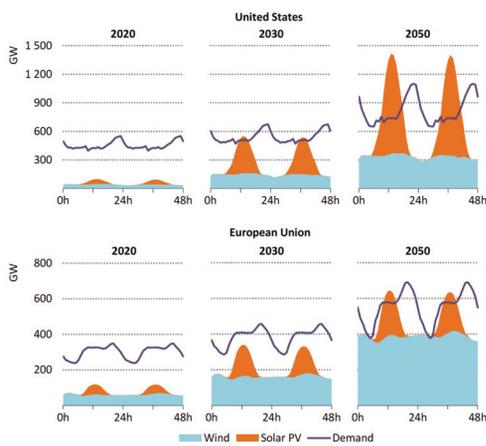
Notes on scale of opportunity



Heat from The Heat Vault is used for district heating, district cooling, electricity or green hydrogen.

The Heat Vault uses excess electricity and waste heat, buying both off peak at low cost and trading energy at other times, making renewables efficient and practical.

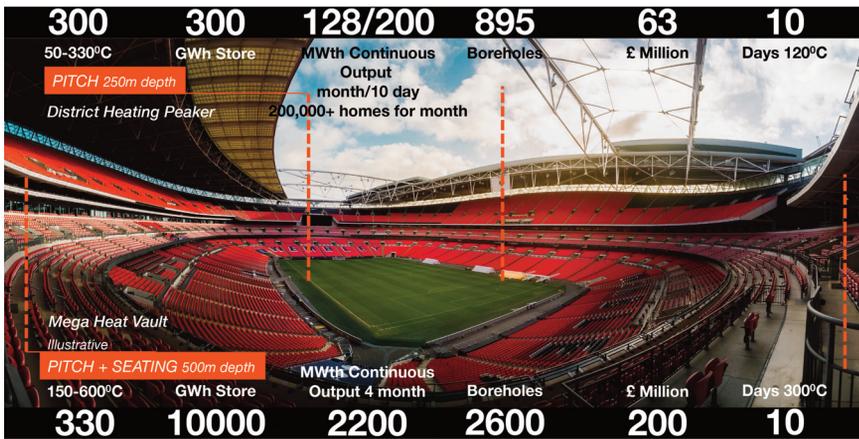
Waste heat can come from nuclear, industrials or renewables. Today, global annual waste heat from solar and wind farms amounts to 3,373 GWh and 75 GWh respectively. By 2050 there is expected to be a 20X increase in solar and 10X increase in wind.



In addition to solar and wind, Heat Vault can also use geothermal heat from deeper boreholes, with continuous low cost supply of energy independent of weather.

Excess electricity can lead to periods of zero prices and costly curtailment. European estimates suggest zero costs for 8% of the time each year at 2050 onwards.

Heat Vault plans purchase of zero or low cost electricity when available, which also reduces the need for curtailment.



There is a large supply market from which energy can be sourced to stock Heat Vault.

There is also a large demand market. World district heating and industrial direct heat demand, for example, is around 4,000 TWh per year.

A district heating peaker plant Heat Vault, which could supply more than 200,000 homes continuously for a month, would fit beneath a soccer pitch.

4 decades of its energy supply could be stored under 30% of Manhattan's Central Park

This Heat Vault would cost around \$10 billion



At the size of Wembley Stadium, a baseload Heat Vault can provide continuous supply at 30X the scale of the peaker for a full winter season of four months.

And as we consider the global growth of megacities, some with populations of 40 million plus, there's a bigger opportunity still.

Take New York. Based on today's energy consumption (around 11 GWh/day), it would be possible to scale a Heat Vault at 100X Manhattan's annual need for continuous energy security, for a cost of just \$10 billion.



Judith Agar
*Marketing Director
& Company
Secretary*

Head of Management Services Virgin Money. Marketing & Communications Director & Company Secretary Intelligent Energy. HSBC Commercial & Corporate Banker. Credit & Risk Manager Trinkaus & Burkhart Germany. Operations Director UBS. AT Kearney Associate for sovereign governments and major corporations. Professional qualifications Chartered Institute of Bankers, the Association of Corporate Treasurers and the Chartered Institute of Marketing. Masters degree from Edinburgh University in German and Russian. MBA at Cranfield University School of Management.



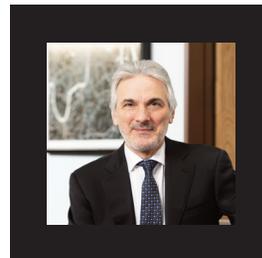
Dr. Harry Bradbury
Chairman & CEO

Academic career in both UK (Cambridge and London) and as Yale University Professor in Earth and Planetary Sciences. Founder and CEO of two successful public (London Stock Exchange) Anglo-American groups of companies in environment (ESG) and hydrogen technology. Achievements included world's first hydrogen airplane with partner Boeing and multi-award winning world's first hydrogen electric motorbike. Leadership in three of the world's largest advisory firms: Deloitte (Managing Partner for 20 Central European countries); Booz.Allen & Hamilton (Europe Middle East and Africa Leader for its World Technology Business based in Paris); and AT Kearney (Emerging Markets Leader based in London). First Chief Economic Advisor to Kingdom of Bahrain Government. Fellowships include Royal Society of Chemistry and Institute of Engineering and Technology. Honorary Fellow Argentinian Engineering Centre. Member of the Athenaeum.



Alison Cavey
ESG Director

Director Orion Innovations working as Interim Managing Director, Outcome Manager and Lead Consultant to more than 100 start ups and SMEs. Advisory services to more than 30 regional, national and international agencies. Director of Business Development and Executive Corporate Management, Intelligent Energy. Strategic business management with leading international firms including Arup, A. T. Kearney and Booz Allen & Hamilton. Advisor to International Finance Institutions and corporate blue chip clients, and has worked in Southern and Northern Africa, Canada, China, Central and Eastern Europe, and Australia. ESG Advisor with RPS Group, Ove Arup and Partners in London and Camp, Scott and Furphy in Australia. First Class Honours degree in Natural Environmental Science from Sheffield University. MSc in Water Pollution Control Technology from Cranfield University.



Peter Coward
*Chief Financial
Officer*

PriceWaterhouseCoopers Senior Partner (1989-2017). Specialist International Tax planning & property. Head Property Tax Division. Clients included Ineos, Sage, Hiscox, Arriva, Grainger Trust, Pamplona Capital, TR Property Trust, Big Yellow. Numerous fund raises and refinances (bank consortiums and quoted bonds) £200 m-£750m plus larger refinances. Significant number sell and buy side corporate transactions. Numerous property fund structures and quoted REIT's. Non Executive Director Triple Point Social Housing REIT plc, True Potential Ltd, Chancerygate Ltd , MFDevCo Ltd and M2M Europe Enterprises Ltd.



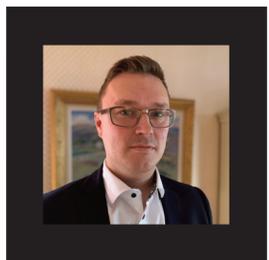
**Dr. Johan
Hogmalm**
Chief Scientist

Geoscientist with a strong background in R&D and management in energy and natural resources from both academia and industry. Globally recognised expert in development of in situ dating of minerals using isotopic systems, which established a major breakthrough in the field of geochronology. Founder and director of mineral exploration company Svenska sandprodukter AB, successfully leading complex and multidisciplinary projects in mineral resource development. Since beginning 2020, Principal Investigator for a deep geothermal exploration program in Gothenburg, in close collaboration with an industrial company. Co-Founder of Electroock Storage AB (now The Heat Vault Company Nordic AB).



Kevin Mallin
Technical Director

Four decades of global experience across resource drilling and exploration, including geothermal, mineral and oil and gas sectors. Wide variety of research and development projects concerning deep energy resources. Various Managing Director level positions with leading companies such as H&F (later Atlas Copco), and Dando International. EMEA Regional Director for Ingersoll Rand Deep Drilling Development Oil and Gas Division. Founder of specialist drilling companies such as Bluewater. Various board and advisory roles including leadership for an eleven-nation consortium in deep geothermal drilling developments. Qualifications from Robert Gordon University and previous Winner of media Achievement Awards. A highly accomplished climber with numerous interests in geology.



Jakob Isaksson
*Chief Operating
Officer*

Operations leadership of Swedish land development and geotechnical business. Research, teaching, technology and administrative management positions within University of Gothenburg including operations related to 2,500 personnel at Sahlgrenska Academy. Specialisations in geosciences to Masters level. Co-Founder of Electroock Storage AB inclusive of prototyping, field trials, commercial negotiations and intellectual property development and registration. External programmes with Linnaeus University, California Institute of Technology and Tokyo University. Military service completed as Second Lieutenant.



**Lily Mindham-
Walker**
Project Manager

Associate with Imaginatives Group based in London. Project Management for wide variety of Sustainable Economic Development Projects in South Africa, Ghana and Argentina. Future City specialist projects in waste management, healthcare, tourism & leisure, agriculture and aquaculture. New Materials project management in mycelium business development and biomass future markets Healthcare project management in mobile clinics, preventative medicine and vaccination linked to Government and NGO activities. Circular Economy, Hydrogen Economy and National energy sector analysis. Lead Project Manager for a novel online global innovation platform, including product demonstration, partner relations and business planning. Voluntary and Charitable positions. Duke of Edinburgh Award. Bachelor's degree in Human Geography and Environment from University of York.

**Pablo Bereciartua. Latin America**

Former Secretary of Infrastructure and Water for Argentina. President Water Planning Agency for the Buenos Aires metropolitan area. Board member Matanza Riachuelo River. Director of Infrastructure for the City of Buenos Aires. Founder Bereco Innovation Labs. Dean of the School of Engineering and Management of the Buenos Aires Institute of Technology. Professor of the University of Buenos Aires. Professor Buenos Aires Institute of Technology, Innovation and Competitiveness. Advisory Board of the EIT Climate KIC institute Netherlands. Yale University World Fellow, Eisenhower Fellow, Fulbright Scholar IIASA fellow and the prizes Ing. Antonio Marin and Ing. Enrique Butty awarded by the Argentinean National Academy of Engineering. President of the Argentinean Engineering Center. Education in Argentina, Delft, UC Berkeley and at Yale University

Paul Booth CBE OBE. UK

Chairman of Saudi Basic Industries Corporation UK Petrochemicals and European Director of Government Policy Global Chemicals Sector. Experience through positions in Europe and USA. Member of the Chemicals Industry Association Council Chairman of the North East Process Industry Cluster (NEPIC) Chairman Tees Valley Unlimited Local Enterprise Partnership. Board of Governors Teesside University. Member of TTE Technical Training Group and The National Skills Academy Process Industries. National Chemical Growth Strategy Partnership as Principal Advisor to the British Government. Awarded Order of the British Empire for services to the Chemical Process Industry New Year's Honours List of 2013 and CBE in 2020.

Peter Corne. China

Two decades Leader and Managing Partner of US Law firm Dorsey & Whitney's mainland China offices based in Shanghai. Specialisations include Chinese corporate, commercial and regulatory practice with a great deal of focus on environmental law and climate change. Co-Head of the Firm's Clean Technology Practice Group. Recognised as a leading practitioner in the field of mediation and arbitration. Positions on 13 arbitration commission panels throughout China. Managing Partner of Dorsey's Shanghai office. Co-Head of the Firm's U.S.-China Practice Group. Qualified to practice in England & Wales, Hong Kong and Australia. Global Adjunct Professor at NYU Shanghai, where he taught International Mediation and Arbitration in 2018 and 2019 and will teach Experiential Mediation in 2022.

John Glen. Europe

Chairman of global conglomerate BIC. Chief Executive Officer Buccleuch Group owned by His Grace Duke of Buccleuch and Queensberry, largest UK private landowner 90,000 hectares valued at \$1.3 bn with \$1bn business parks, industrial assets, offices, housing developments and hotel management across UK. Chief Financial Officer & Vice President of Finance & Administration of Air Liquide the €48 billion market cap Paris HQ business based in 48 countries with 66,000 employees. Unilever National Finance Director France. Executive Vice

Chairman European Financial Reporting Group. Director TR Property Investment Trust PLC. Edinburgh University Master's Degree in Economics. Qualified Certified Accountant

Carl Helge Josefsson. USA

More than 35 years of international investment banking experience, working in Los Angeles, New York, Monaco, Luxembourg, London and Stockholm focussed on Private Equity, Asset Management, Financial Advisory and Mergers & Acquisitions. CEO and Head of Corporate Finance at Enskilda Securities, Inc., New York, a previously wholly owned subsidiary of Skandinaviska Enskilda Banken, SEB, in Sweden. Lead M&A Alliance with The Blackstone Group, as a Senior Managing Director. Director & Executive for more than 20 years at Enskilda Securities. Transactions to a value of more than US \$ 30 billion in principal industries such as renewable energy, hotel & leisure, real estate, retail, software and logistics. Master of Law and Business Management degrees from Stockholm University and Stockholm School of Economics. Lives in Los Angeles.

Michael Lee. Middle East

Merrill Lynch Managing Director following investment banking assignments in London and Hong Kong. Director of Corporate Development, Merrill Lynch International Inc. New York. Chief Executive Officer, Dean Witter Capital Markets-International London. MD Corporate Finance, Dean Witter Reynolds Inc. New York. Advisor Financial Markets Bahrain Ministry of Finance & National Economy. CEO of Bahrain-based investment bank. Deputy Chairman & Managing Director of Emerging Markets Partnership (Bahrain), the General Partner and Manager of the Islamic Development Bank (IDB) Infrastructure Fund. Oxford and Open University graduate

Gillian Watson. Scotland

Managing Director and Head of Power & Energy at Noble and Company, a prestigious Scottish investment bank. Gillian's previous experience includes seven years in investment banking in both London and Hong Kong, where she covered China, Singapore and Indonesia across a range of investment banking products. Thereafter she spent ten years in the power and energy sector in the UK and continental Europe, where she held senior management positions relating to company strategy and business development. Between 2003 and 2005, Gillian was the Director of Corporate Strategy at Endesa SA with responsibilities across all of Endesa's business units. She joined Noble & Co in 2013. Non-Executive Director roles include: Martin Currie Global Portfolio Trust, Royal Edinburgh Military Tattoo, Boswell Trust, Speymalt Whisky Distributors Ltd, Meallmore Limited, Scottish Friendly Assurance Society Limited and DC Alpha Investments SPC Ltd. Formerly Non-Executive Director for Scottish Enterprise.

