

CLEANTECH 50TOWATCH

The early-stage companies taking
action on the climate crisis

From Commitments to Actions:
The Sprint to Net Zero is On





Contents

Foreword _____ 3

The 2022 Cleantech 50 to Watch Company Map _____ 4

Case Studies _____ 6

 Dioxcycle _____ 6

 Heat Inverse _____ 8

 Inseco _____ 10

 Phycobloom _____ 12

 Ryp Labs _____ 14

The 2022 Cleantech 50 to Watch List _____ 16

About Cleantech Group _____ 22

Expert Panelists _____ 23



Foreword

Nisa Mirza / Associate, Data & Ecosystems

Solutions and technologies needed to reach our climate goals already exist and have proven to be profitable.

“We are heading in the wrong direction.”

This was the key message from the World Meteorological Organization’s recent multi-agency report on the state of climate change. Natural disasters are increasing in both frequency and intensity—2022 alone experienced floods, wildfires, droughts, tornados, heatwaves, and landslides to count a few. Europe, Pakistan, United States, Australia, South Africa, Chad—the story is the same everywhere.

Simply put, we are not doing enough to prevent a catastrophic tipping point.

To limit global warming to 2 °C, current 2030 mitigation pledges need to be 4 times higher (United in Science, 2022). After the pandemic-induced outlier dip in CO₂ emissions, global fossil CO₂ emissions have rebounded to record-high levels. Ocean Heat Content is also at an all-time high, posing a significant threat to coral ecosystems. Glacial mass is rapidly decreasing, increasing flooding risk and affecting millions of people.

But we have reason to be optimistic.

Climate change is evident now more than ever—individuals, companies, governments are becoming increasingly aware of their contribution to climate change, as well as the effort needed to mitigate their impact. Sustainability is becoming a core principle of business models, emphasizing the need to integrate environmental-conscious practices in all aspects of operations.

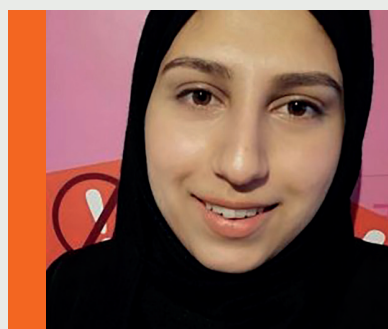
Solutions and technologies needed to reach our climate goals already exist and have proven to be profitable.

Clean technologies such as *renewable energy, electric vehicles, carbon management and recycling* are now mainstream, but further policy work and infrastructure is needed to drive efficient mass adoption on a scale large enough to keep us on track. Early-stage solutions need continued support from investors, corporates, and governments to develop and scale to make an impact.

The fourth publication of the **Cleantech 50 to Watch** continues to highlight and applaud the early-stage companies bringing forth state-of-the-art solutions; this year in *carbon capture, regenerative agriculture, water scarcity, circularity, energy and mobility*. With valuable input from 31 leading specialists, the 2022 list is at least 50% diverse and 40% female-founded. All of them are addressing crucial challenges and have the potential to shift us in the right direction.

The sprint to net zero is indeed on.

N. Mirza





Company Map

Presenting the 2022 Cleantech 50 to Watch Companies by category

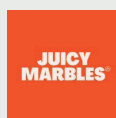
Carbon Capture and Regeneration



Future of Food

DRAWDOWN
FOODS ...

inseco



typ LABS

Advanced Materials and Processes

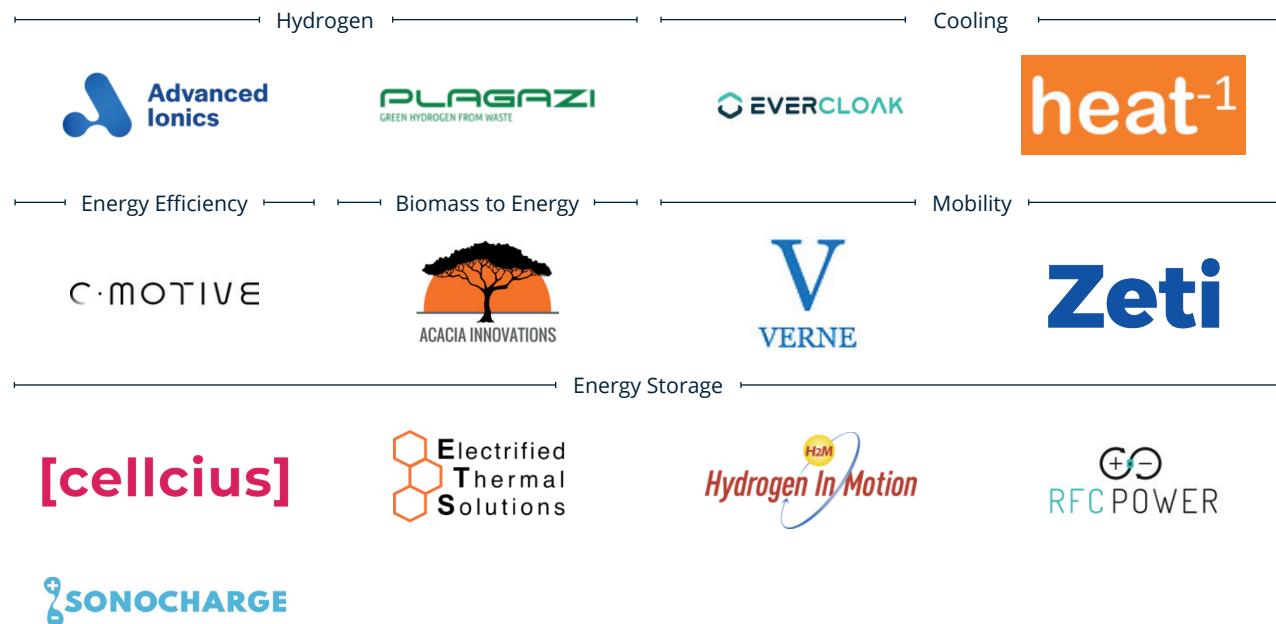




Company Map

Presenting the 2022 Cleantech 50 to Watch Companies by category

Energy and Mobility



Water Scarcity



Circularity





CASE STUDY

Capturing Carbon at Source

THE CHALLENGE

INDUSTRIAL DIRECT GREENHOUSE GASES EMISSIONS
AMOUNTED TO ~8500 MTCO₂eq IN 2020*

*International Energy Agency, Industry direct CO₂ emissions
in the Net Zero and Announced Pledges scenarios, 2021

CASE
STUDY



About Dioxycle
Company founded: 2020
Number of employees: 2-10

A SOLUTION
INTEGRATED MODULAR ELECTROLYZER SYSTEMS TO CAPTURE
AND CONVERT INDUSTRIAL CARBON DIOXIDE EMISSIONS

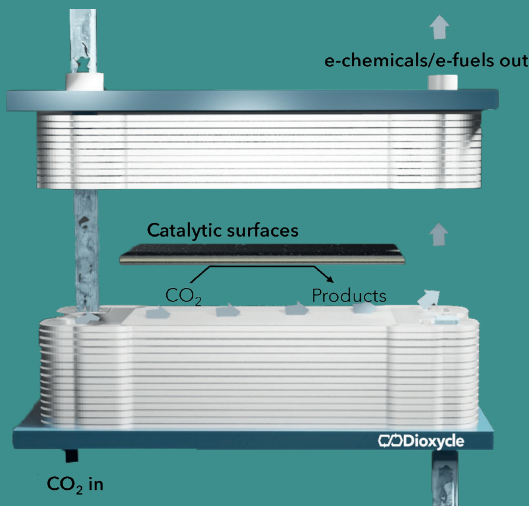
THE KEY NUMBERS

Individual cells can convert
>80 KG OF CO₂
per m²

How it works
Dioxycle has developed low-temperature electrolyzers made up of stacked cells, that convert carbon dioxide into other chemicals using water and electricity on catalytically active surfaces. The solution can be used to produce building blocks such as carbon monoxide, syngas and ethanol, vital in the fuel and energy industries.

Potential impact
The solution not only captures carbon from the point source of emission but also but also produces valuable commodities that are traditionally produced using fossil fuels. The company is currently utilizing electricity from decarbonized grids, decreasing its environmental footprint.

Ambition
Dioxycle aims to partner with industrial carbon dioxide emitters in hard-to-abate sectors such as steel, chemistry, aviation fuels and cement to support them in their decarbonization efforts. The company will be moving to pilot its solution next.



THE KEY NUMBERS

Solution can potentially
displace over
600 MTCO₂/YEAR
by 2050



CASE STUDY

Making Cooling Sustainable

THE CHALLENGE

AUXILIARY ENGINES FOR TRANSPORT REFRIGERATION CAN PRODUCE 3 TO 15 TONNES OF CO₂ PER YEAR, AS WELL AS 16 TIMES MORE NITROGEN OXIDES AND 40 TIMES MORE PARTICULATE MATTER THAN THE TRUCK'S MAIN ENGINE*

*CENEX, Refrigerated Transport Insights, 2021

CASE
STUDY



About Heat Inverse
Company founded: 2018
Number of employees: 2-10

A SOLUTION
A THIN FILM THAT PROVIDES COOLING
BY REVERSING HEAT ABSORPTION

How it works
Heat Inverse has developed a proprietary hyper-emitter that emits light at specific wavelengths that are not trapped in the earth's atmosphere, effectively moving heat from the object to space.

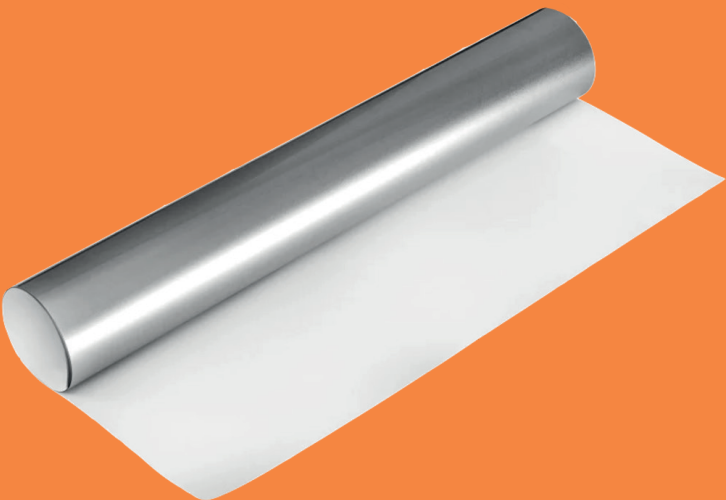
Potential impact
The solution provides cooling through no energy input, drastically reducing energy and fuel costs as well as their associated emissions. The film also extends asset lifetime as it reduces deterioration by the heat produced.

Ambition
The company is currently piloting its solution in the refrigerated trucking industry, the solar industry to measure the effect of cooling on energy output, and in energy systems to assess asset condition. It will aim to scale its production capacity next.



THE KEY NUMBERS

Film can provide
25-80%
of required cooling in a
40-foot refrigerated truck



THE KEY NUMBERS

Carbon dioxide emissions
can be reduced by
**20 MILLION
METRIC TONNES**
per year in the refrigerated
trucking industry.



CASE STUDY

Sustainable Protein & Feeds

THE CHALLENGE

**WORLD'S POPULATION IS EXPECTED TO EXCEED 9 BILLION
BY 2050, WITH A 23% INCREASE IN RESOURCE-
INTENSIVE LIVESTOCK PRODUCT REQUIREMENTS***

*World Resources Institute, The Global Food Challenge

CASE STUDY



About Inseco

Company founded: 2017

Number of employees: 2-10

A SOLUTION

INSECT-BASED PRODUCTION SYSTEM TO TRANSFORM ORGANIC WASTE INTO ANIMAL FEED



THE KEY NUMBERS

Capacity to convert

40 TONNES

of feedstock to

~3 TONNES

of oil,

~14 TONNES

of fertilizer and

2 TONNES

of protein per day

How it works

The company uses black soldier fly to produce larvae in controlled units. The larvae are fed non-consumer organic waste, such as fruit and vegetable peels, which the larvae feeds on and converts into fertilizer. The mature larvae is pressed to extract its oil content, with the dried larvae milled into animal feed. The larvae takes 10 to 12 days to feed on the organic waste.

Potential impact

The solution provides a less resource-intensive alternative protein and oil to include in pet, poultry and fish feed whilst eliminating organic waste and its associated carbon footprint. It also offers reduced dependency on fishmeal and fishoil, promoting marine biodiversity.

Ambition

The company plans to increase its manufacturing capacity at its plant in Cape Town, South Africa, and build new plants across Africa. It also plans on increasing its customer base across Africa as well as in Europe and the United States.





CASE STUDY

Reducing Fossil Fuel Reliance

THE CHALLENGE

GLOBAL FOSSIL FUEL CONSUMPTION EQUALED ~136,000 KWH
IN 2021, WITH THE TRANSPORT SECTOR ACCOUNTING
FOR ~16% OF CARBON DIOXIDE EMISSIONS IN 2016*

*Our World in Data, Fossil Fuels, 2021

CASE STUDY

phycobloom

About Phycobloom

Company founded: 2019

Number of employees: 2-10

A SOLUTION

NOVEL STRAINS OF ALGAE THAT USE ATMOSPHERIC CARBON DIOXIDE TO PRODUCE HYDROCARBONS



THE KEY NUMBERS

10 TIMES

more energy needed
to extract oil from algae
traditionally than
from soybeans

How it works

The company has developed a proprietary strain of algae with modified genetics that excretes the oil it produces. The system is fed with captured carbon dioxide, air, water and nutrients such as phosphorus for the algae to grow. Once fully grown, the algae will start producing and excreting oil that forms an insoluble layer in the tank/system which can be tapped.

Potential impact

The process eliminates the need for expensive drying and processing technology to extract oil from traditional algae production systems and as compared to conventional systems. The solution does not harm the algae either, allowing reuse along its lifetime. The process also uses reduced volumes of fertilizers as compared to conventional systems, reducing the environmental footprint of its process.

Ambition

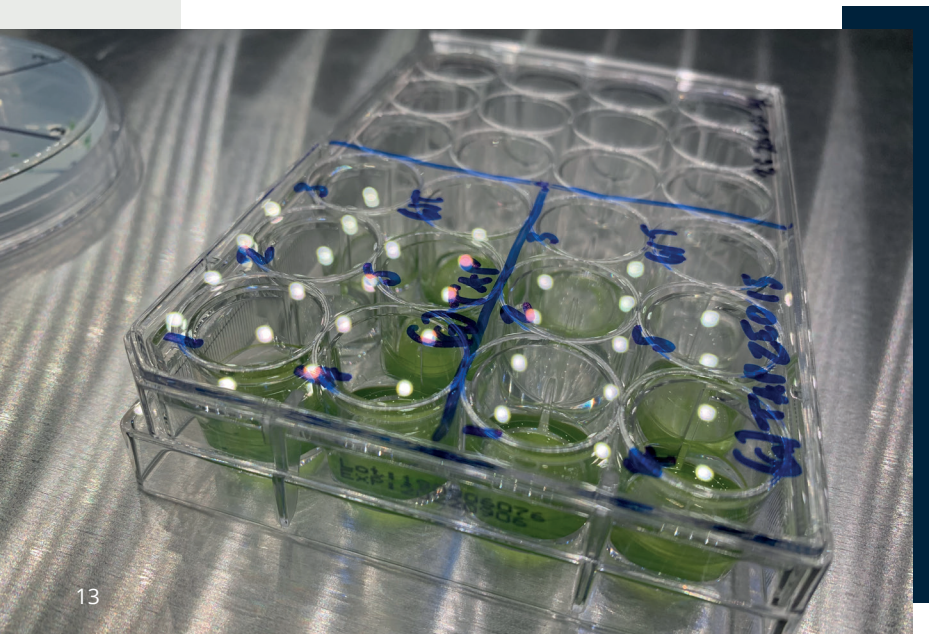
The company aims to scale its operations next, enabling production of biofuel at a commercial scale. It also aims to partner with industry, to enable both upstream carbon capture for its feedstock and downstream processing of its oil.



THE KEY NUMBERS

Solution could decrease cost of
final product by up to

70%





CASE STUDY

Reducing Food Waste

THE CHALLENGE

A THIRD OF THE FOOD PRODUCED GLOBALLY FOR HUMAN CONSUMPTION IS WASTED EVERY YEAR, WITH FRUITS AND VEGETABLES HAVING THE HIGHEST WASTAGE RATE AT 50%*

*UNEP, ThinkEatSave, 2021

CASE STUDY



About Ryp Labs

Company founded: 2017

Number of employees: 2-10

A SOLUTION

A BIO-INHIBITOR-BASED FORMULATION THAT CAN BE APPLIED VIA STICKERS OR LABELS TO EXTEND SHELF-LIFE OF FRESH PRODUCE



THE KEY NUMBERS

Food waste amounts to
\$2.6 TRILLION
in losses annually
and accounts for
6%
of global greenhouse
gas emissions

How it works

Ryp Labs's proprietary formulation releases vapor-based bio-inhibitors to slow down decay for up to 2 weeks without any direct contact with the produce. The formulation can be delivered through a variety of methods including coated stickers or sachets that can be placed in food containers.

Potential impact

The solution offers a simple yet effective method to address a major global problem, helping improve food security, reducing the pressure on natural resources to grow vast amounts of food, as well as reducing wastage and its associated carbon footprint.

Ambition

The company is currently piloting with distributors and resellers and plans to commercialize as well as expand globally. Ryp Labs will also look into expanding across the food industry to preserve products other than fresh produce and sell directly to consumers as well.



THE KEY NUMBERS

15% - 30%
reduction in food losses
in pilots conducted
by Ryp Labs

CLEANTECH 50TOWATCH









The 2022 List





Agriculture & Food

8 COMPANIES ↓ | 6 COUNTRIES ↓

COMPANY	DESCRIPTION	COUNTRY	FOUNDED
 Agricarbon	Provider of soil carbon content testing solutions	United Kingdom	2018
 Deep Branch	Developer of process to transform CO ₂ into agrifood protein products	United Kingdom	2018
 DRAW DOWN FOODS	Developer of plant-based food ingredients using regenerative agricultural practices	Kenya	2021
 inseco	Developer of production system to transform organic waste into animal feed	South Africa	2017
 JUICY MARBLES	Developers of protein technology for producing plant-based meat whole cuts	Slovenia	2019
 puna.bio	Developer of biological inputs for agriculture that reduce carbon emissions and restore degraded soil	Argentina	2020
 ryp LABS	Developer of fresh produce preservation solutions using a bio-inhibitor sticker	United States	2017
 Steward	Lender of capital to farmers transitioning to regenerative agriculture	United States	2017



Enabling Technologies








1 COMPANY ↑ | 1 COUNTRY ↑

COMPANY	DESCRIPTION	COUNTRY	FOUNDED
 4pi Lab	Developer of Low-Earth Orbit (LEO) satellite constellation providing real-time wildfire detection	Canada	2019



Energy & Power












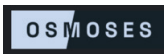


7 COMPANIES ↔ | 5 COUNTRIES ↑

COMPANY	DESCRIPTION	COUNTRY	FOUNDED
 Advanced Ionics	Developer of symbiotic electrolyzers that can utilize waste heat sources for industrial use	United States	2017
 [cellcius]	Developer of a thermal battery that utilizes residual industrial heat	Netherlands	2020
 Electrified Thermal Solutions	Developer of energy storage technology that converts surplus zero-carbon electricity into heat	United States	2021
 Hydrogen In Motion	Developer of mobile hydrogen storage tanks for hydrogen fuel cell equipment or vehicles	Canada	2014
 PLAGAZI <small>GREEN HYDROGEN FROM WASTE</small>	Provider of plasma gasification technology for transforming unsorted waste into hydrogen, synthesis gas and other valuable energy carrier	Sweden	2007
 RFC POWER	Developer of hybrid flow batteries for grid energy storage applications	United Kingdom	2017
 SONOCHARGE	Developers of battery technology that integrates lithium batteries with an acoustic device, enabling rechargeability	United States	2021



Materials & Chemicals

14 COMPANIES ↑ | 9 COUNTRIES ↑

COMPANY	DESCRIPTION	COUNTRY	FOUNDED
 CemVision	Manufacturer of carbon-free cement from upcycled materials	Sweden	2019
 cert	Provider of electrocatalytic conversion technologies for the alteration of CO ₂ into value-added fuels and feedstocks	Canada	2016
 COMPFAIR	Developer of composites materials with healing capabilities	Switzerland	2019
 CRUZ FOAM	Producer of compostable, biodegradable alternative to expanded polystyrene from chitin	United States	2017
 ecoLocked	Manufacturer of biobased additives using waste biomass feedstock that reduce emissions footprint for building materials and concrete	Germany	2021
 epizyme	Provider of enzyme solutions that replace chemicals for use in organic waste processing, soil health and animal feeds	Turkey	2014
 EVERCLOAK	Manufacturer of ultra-thin graphene and other 2D nanomaterial films, increasing efficiency in HVAC systems	Canada	2018
 fairbrics	Developer of virgin synthetic fabrics manufactured with waste CO ₂	France	2019
 heat⁻¹	Developer of a thin film that provides passive cooling	United States	2017
 Humble Bee Bio	Manufacturer of bioplastic using bee DNA and synthetic biology	New Zealand	2010
 mars materials	Producer of acrylonitrile for plastics and carbon fibers using captured CO ₂	United States	2021
 OSMOSES	Developer of molecular filter membranes for industrial chemical separations	United States	2021
 phycobloom	Developer of novel strains of algae that use atmospheric CO ₂ to create hydrocarbons	United Kingdom	2019
 ULTRASONIC TECHNOLOGY SOLUTIONS	Developer of industrial and commercial ultrasonic dryers with reduced energy intensity	United States	2018



Resources & Environment

17 COMPANIES ↑ | 13 COUNTRIES ↑

COMPANY	DESCRIPTION	COUNTRY	FOUNDED
	Developer of a nearly smokeless alternative to charcoal and firewood made of sugarcane waste	Kenya	2016
	Developer of molecular separation technology for recovery of high purity raw materials from any accessible water for energy use and mobility operations	Sweden	2019
	Developer of online recyclimate and plastic waste trading marketplace	Germany	2018
	Developer of polyester rejuvenation technology which offers low energy recycling for used polyester green hydrogen for steel, transport and chemical sectors	Netherlands	2018
	Developer of IoT and digital management tools to manage wastewater plants, wind turbine performance and health	India	2020
	Developer of integrated container-sized modular systems to allow for the controlled capture and treatment of industrial CO ₂ -containing exhausts	France	2020
	Developer of dye extraction and reuse solutions from textile waste services for commercial and industrial buildings	United Kingdom	2020
	Provider of textile supply chain traceability solutions using luminescent markers	Singapore	2018
	Developer of technology that converts substances in polluted air into inks and paints	India	2015
	Developer of technology to convert mixed low-value and high-value plastic waste into construction products	Indonesia	2019
	Developer of agroforestry design, planning and investment platform focused on bridging the capital and operational needs to integrate tree crops into farmland	United States	2016
	Designer of closed-circuit shower that filters, gradually heats and reuses shower water to avoid wasting water or energy	Canada	2019
	Developer of direct air capture technology, using electricity to separate CO ₂ from the air	Israel	2020
	Developer of forestry growth mediums using symbiotic fungi optimized for the local area	United Kingdom	2021
	Developer of sensors to control and monitor water consumption in buildings, preventing leaks	Belgium	2017
	Provider of electrochemical water treatment technologies	Canada	2019
	Developers of decentralized sanitation solutions to treat wastewater, industrial and agricultural waste and convert it to biogas, fertilizers and recovered water	United Kingdom	2017



Transportation & Logistics

3 COMPANIES ↔ | 2 COUNTRIES ↓

COMPANY	DESCRIPTION	COUNTRY	FOUNDED
C·MOTIVE	Developer of a high-efficiency electrostatic motor made using fewer materials	United States	2012
V VERNE	Developer of hydrogen storage solutions for the maritime industry	United States	2020
Zeti	Financier of fleet conversion to electric with pay-per-mile model	United Kingdom	2020

THE 2022 CLEANTECH 50 TO
WATCH LIST FEATURES AMBITIOUS
INNOVATORS, COVERING A DIVERSE
SET OF CHALLENGES ACROSS
MULTIPLE SECTORS.

NISA MIRZA



About Cleantech Group

At Cleantech Group, we provide research, consulting and events to catalyze opportunities for sustainable growth powered by innovation. We bring clients access to the trends, companies and people shaping the future and the customized advice and support businesses need to engage in external innovation.

Industries are undergoing definitive transitions toward a more digitized, de-carbonized and resource-efficient industrial future. At every stage from initial strategy to final deals, our services bring corporate change makers, investors, governments and stakeholders from across the ecosystem, the support they need to thrive in this fast-arriving and uncertain future.

The company was established in 2002 and is headquartered in San Francisco with people based in London, Paris and Boston.



Expert Panelists

These 31 leading specialists provided their inputs into the process.



Laurie Menoud
Partner

At One Ventures



Johanna Wolfson
General Partner

Azolla Ventures



Olga Jensen
Associate

BayWa r.e. Energy Ventures



Ashley Grosh
Vice President

Breakthrough Energy Fellow



Bennet Barth
Managing Director,
RESPOND

BMW Foundation



Iain Meager
Associate Director

Carbon Trust



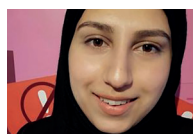
Lou Schick
Director of Investments

Clean Energy Ventures



Erki Ani
CEO

Cleantech Estonia



Nisa Mirza
Associate,
Data & Ecosystems

Cleantech Group



Jason Anderson
President and CEO

Cleantech San Diego



Caitlin Wale
Manager

Counteract



Daniel Matross
Global Head of Research

CREO Syndicate



Olivier Bordelanne
Partner

Demeter IM



Erik Snyder
Founder and CEO

Drawdown Fund



Georgia Parker
Innovation Director

Fashion for Good



Tomas Haglund-Flemström
Head of Impact
and Innovation

Formica Capital



Expert Panelists

These 31 leading specialists provided their inputs into the process.



Chris Sworder
Senior Project Manager
Hatch Blue



Scott Bryan
President
Imagine H₂O



Victor Ndiege
Chief Executive Officer
Kenya Climate Ventures



Tyler Hamilton
Director, Cleantech
MaRS



Monali Mujumdar
Startup Engagement Lead
and Program Operations
NREL



Pat Sapinsley
Managing Director
Cleantech Initiatives
NYU Urban Future Lab



Marie Thompson
Principal
Powerhouse



Max ter Horst
Managing Partner Energy
Rockstart Accelerator



Klaus Oberbauer
Program Manager,
Ocean Plastic
Prevention Accelerator
SecondMuse



Victoria Smaniotto
Head of Outreach
Solar Impulse Foundation



Demetrius Yuen
Director of Programs
SOW Asia



Guillaume Boury
Investment Associate
Telos Impact



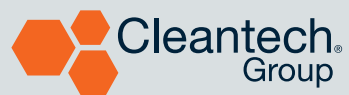
Alexander Langguth
Managing Partner
Übermorgen Ventures



Sunyoung Suh
Sustainable Energy Expert
United Nations Industrial
Development Organization



Pippa Gawley
Founding Partner
Zero Carbon Capital



San Francisco

600 California Street, Floor 11,
San Francisco, CA 94108
United States

+1 (415) 233-9700
info@cleantech.com

Cleantech Group Europe Ltd

c/o 5 New Street Square,
London EC4A 3TW
United Kingdom

+44 (0) 203-743-8615
info@cleantech.com

cleantech.com