

# Baseline Study "Cleaning up with AI"

February 2024

## Executive Summary

## Section 1: Establishing the Landscape

- CleanAI: What is it?
- Demand for CleanAI
- Investing in the Transition
- Supply of CleanAI
- Challenges

## Sections 2-6: CleanAI in each of the Cleantech Industry Groups

2. Agriculture & Food
3. Energy & Power
4. Materials & Chemicals
5. Transportation & Logistics
6. Resources & Environment



- Overview
- Investments Trends
- Landscape
- Market Trends
- Innovator Profiles

## Looking Forward

# Executive Summary: Scope of the Baseline Study

**Purpose of the Study:** Establish an initial landscape of AI-enabled cleantech solutions ("cleanAI") with key trends to identify, assess and monitor opportunities that impact the clean economy transition.

## Innovators Scope:

- Cleantech companies with AI as a **core differentiator** in their business model
- Cleantech companies with AI as a **critical component** of their service offering or as a part of a product that is materially advanced by use of AI

*Note:* We do not include companies using generative AI in the scope of the report

## Methodology:

- Conduct secondary research using Cleantech Group's proprietary data, including i3 database, internal knowledge and external sources to identify and gather information about cleanAI
- Conduct primary research interviewing innovators, ecosystem members and investors to gather and synthesize their insights

## Covered Industry Groups (with example segments):



### Agriculture & Food

Plant-based proteins, regenerative agriculture, biofertilizers, soil carbon



### Energy & Power

Innovative renewables, long-duration energy storage, grid flexibility, green H2



### Materials & Chemicals

Biochemicals, advanced materials, carbon to fuels



### Transportation & Logistics

Electric vehicles, sustainable aviation fuels, clean shipping



### Resources & Environment

Carbon Capture and utilization, water efficiency, waste sorting, construction

## Definitions:

- **Cleantech** innovative technology and business models with solutions to climate challenges. Solutions are inherently designed to:
  - Provide superior performance at lower costs
  - Greatly reduce or eliminate negative ecological impact
  - Improve the productive and responsible use of natural resources
- **Artificial Intelligence (AI)** refers to software to perform tasks like pattern recognition and problem solving based on multi-dimensional data to draw insights, drive analysis and guide decision making

# Executive Summary: Demand for CleanAI

AI-enabled cleantech solutions help to address climate challenges across different industries

## Climate Challenges

### Agriculture & Food

- Losing cultivable land
- Increasing input costs
- Food waste and water use reduction

### Energy & Power

- Asset resilience
- Increased complexity across markets, grid and distributed assets
- Siting new builds

### Materials & Chemicals

- Performance improvement
- Energy usage improvement
- Waste reduction

### Resources & Environment

- Hazard prediction
- Leak detection
- Waste reduction

### Transportation & Logistics

- Optimizing performance, safety, efficiency
- Emissions reduction
- Rising energy demand of electric mobility

## How is AI solving the problem

- Driving operational efficiency, i.e., in crop management, livestock management.
- Product formulation and discovery (alternative proteins, identification of microbes)

- Optimize energy assets, forecast supply and demand, provide grid analytics, and enable predictive maintenance.
- AI and ML used for more advanced modelling and simulations in fusion and energy storage.

- Optimization in industrial processes
- Discovery for advanced materials, catalysts, semiconductor and biochemicals
- Energy use improvement

- Automation of sorting and collection
- Air quality forecasts
- Wastewater treatment, monitoring and management
- Optimization of on-site operations
- Enabling real-time MRV

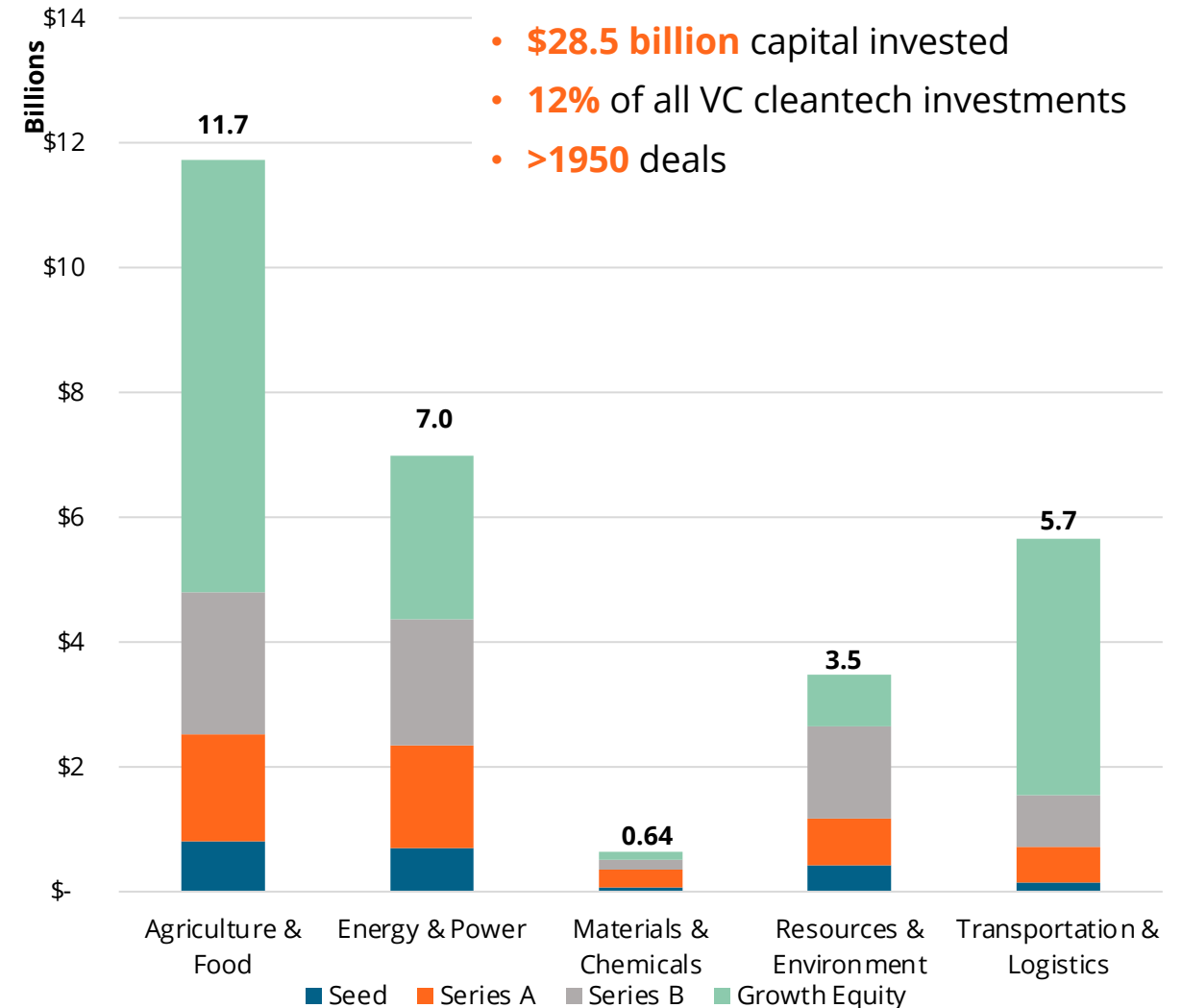
- Route and scheduling optimization
- Energy asset management, energy storage, and on-site energy production assets
- Load shifting for smart charging



# Executive Summary: Key Trends in CleanAI

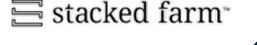






















- 1. AI has significant potential to enable a clean economy** in areas like materials creation and discovery, forecasting, advanced modeling.
- 2. Of the almost \$30 billion** of risk capital invested in the last six years, **70% has been in early-stage innovators.**
- 3. Differentiated business models and data strategies with targeted application** will be key to value creation and impact.
- 4. C-suite and operational champions with domain expertise and willingness to test new systems** will be critical to scaling to widespread market adoption.
- 5. Connecting a fragmented ecosystem and increasing public policy support** will further accelerate AI's positive clean economy impact.

Investments in AI-Enabled Cleantech Innovation in 2018-2023



# Executive Summary: Supply of CleanAI

Cleantech innovators are integrating AI capabilities across different roles

		Agriculture & Food	Energy & Power	Materials & Chemicals	Resources & Environment	Transportation & Logistics
Role of AI						
Control	Resource allocation	AI-controlled indoor farms 	Microgrid Control & Management 	Catalyst discovery  	Computer vision/ automated waste sorting 	Aggregation & Management of energy assets 
Forecast	Accelerate Discovery, Predict Demand	Prediction of breeding combinations 	Predictive Analytics & Maintenance 		Climate risk modeling  	Optimization of grid / EV charging stations 
Optimize	Increase Process Efficiency	Precision application of agrochemicals 	Battery Production Ultrasound Scanning 	Iron and steelmaking optimization  	Wastewater operations optimization 	Logistics/ Route Optimization 
Measure	Monitor & Analyze data	Agri-commodity grading using computer vision 	Market Optimization 	Chemical process optimization  	Carbon footprint tracking 	Traffic management and analysis 

**Note:** Companies used for illustrative purposes, refer to Sections 2-6 for sector-specific landscapes

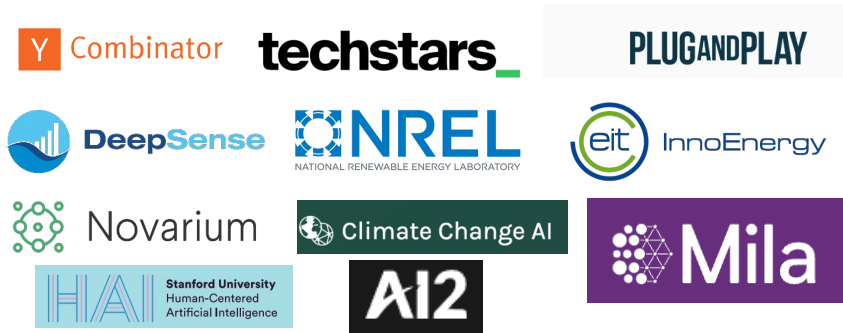
# Executive Summary: Where to Watch for CleanAI

Risk capital firms as well as corporates, research institutes and incubators play pivotal role in developing and supporting AI-enabled cleantech innovation on all stages of development

## Early Innovators

Research Institutes, accelerators, granting agencies

Supply



## Commercializing

Corporate engagement



## Series A and below

Investors



## Series B+



# Executive Summary: Potential Capital Opportunity for CleanAI

There is a rising opportunity for targeted AI-enabled cleantech solutions

**CleanAI will require at least \$138 BN of capital over the next 5 years**

	Capital supplied, 2018-2023	NVCA capital demand to supply ratio, Q3 2023	Base Case: Capital Supply required, 2024- 2028	Accelerated Growth (2x past 5 years): Capital Supply required, 2024-2028
<b>Early Stage</b>	US\$ 7 BN	1.5	US\$ 11BN	<b>US\$ 22 BN</b>
<b>Late Stage</b>	US\$ 21.5 BN	2.7	US\$ 58 BN	<b>US\$ 116 BN</b>

Source:  Cleantech Group



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