BCG

Executive Perspectives

US Inflation Reduction Act: Clean Tech Growth Opportunities & Value Pools

October 2022

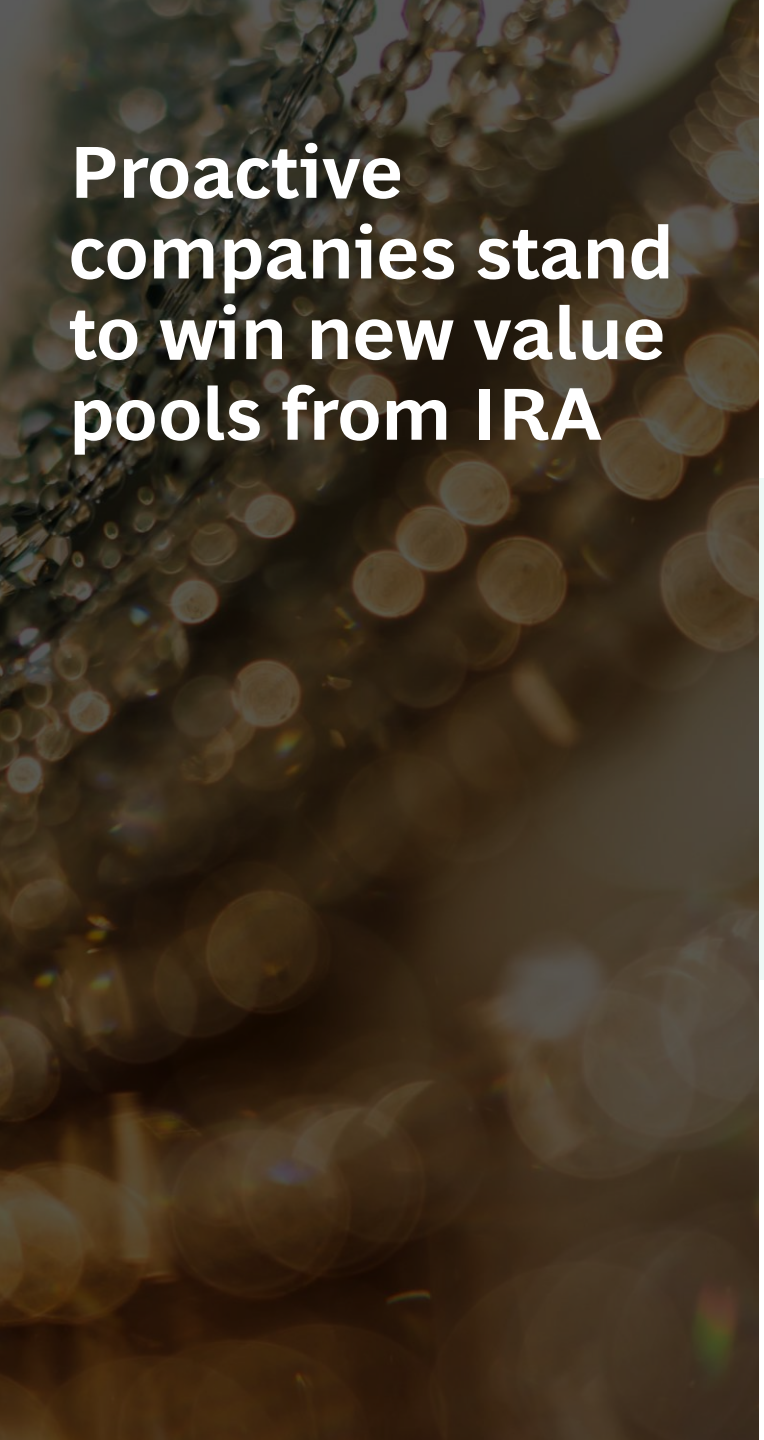
Introduction to this document

With $369B in funding earmarked for climate and energy, **the recent US Inflation Reduction Act (IRA) will drive new clean tech opportunities both in the US and globally**. Through the IRA, companies directly involved in the energy transition (e.g., renewable energy, alternative fuels, electric vehicles) will be able to cut cost, drive growth, and cultivate innovation. Moreover, ripple effects will be felt throughout the supply chain as new market opportunities arise to support growth in the clean tech sector.

This BCG Executive Perspective, the third in our series on the US Inflation Reduction Act, explores the clean tech growth opportunities that will come directly or indirectly as a result of the bill, barriers to growth, and how companies can achieve competitive advantage.

For previous analysis, please see:

- Part 1 | US Inflation Reduction Act: Climate & Energy Features and Potential Implications
- Part 2 | US Inflation Reduction Act: Broader implications for corporate decarbonization



Proactive companies stand to win new value pools from IRA

1 Clean tech growth opportunities:

Three ways to take advantage of new value pools created by the IRA

- **Directly develop projects:** Many companies can participate in climate tech markets, e.g., renewables, hydrogen, carbon capture, etc.
- **Participate in the broader value chain:** New markets also create opportunity for companies that support the climate tech ecosystem such as finance, construction, raw materials, and machinery
- **Make low carbon products:** Companies can capture value by making net-zero products, e.g., using hydrogen to produce low-emissions chemical ingredients for a net-zero pharma company

2 Overcoming bottlenecks:

Despite strong incentives, barriers may delay growth opportunities

Although briefly mentioned in prior materials, barriers across several areas may delay growth opportunities:

- **Regulatory clarity around the IRA:** Multi-year process establish what qualifies under tax law and regulation
- **Permitting, stakeholders, and state/local political barriers:** Getting ahead of lag times and balancing of multiple stakeholders needed; permitting processes poised for streamlining
- **Enabling infrastructure:** Physical, digital infrastructure needed for integrated decarbonization
- **Supply chains:** New supplier relationships and circularity require time and investment
- **Resource availability:** New models required to solve rising scarcity for sustainable inputs
- **Workforce:** Growing demand for workforce adept in clean tech

3 Securing competitive advantage:

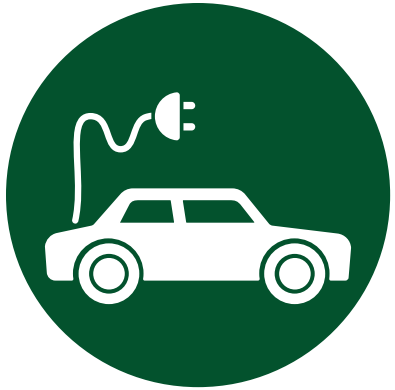
Early entrants into new clean-tech industries may gain first mover advantage

- Move quickly: Early entrants to the clean tech space have historically gained larger market share than their competition, with strong examples from electric vehicle (EV) and energy efficient lighting
- Secure supply: Supply scarcity and the need to navigate domestic content requirements, especially for material inputs (e.g., green steel, green hydrogen), will affect pace of change and growth strategy
- Consider technological maturity: Winning strategies will differ for nascent technologies (e.g., hydrogen, CCUS) compared to mature technologies where scale and implementation are key

1 Develop projects| $479B[1] in new climate and energy finance will catalyze $1.3T[2] opportunity for companies directly involved in climate mitigation

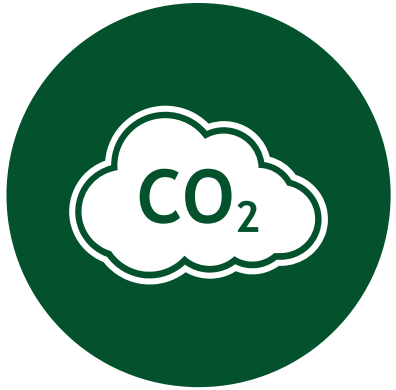
Carbon-free energy

Direct tax credits will drop the cost of renewable energy 18-63% accelerating the pace of redeployment



Transportation

Electric vehicle incentives (up to $7500 for a new and $4000 for a used EV) will drive down cost and increase demand for new EVs and EV charging infrastructure



Clean Tech

Blue and green hydrogen will soon be cost competitive with fossil-derived hydrogen and the 45Q tax credit will make CCUS and DAC more accessible, capping the cost of achieving Net Zero

Manufacturing

$71B in stimulus for advanced manufacturing and industrial facilities will expand adoption of energy efficient technologies and materials including heat pumps and leak detection and repair (LDAR)

For more details, see US Inflation Reduction Act: Climate & Energy Features and Potential Implications
1. Note: $479B Includes funding from Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA) 2. Over the next 10 years
Source: BCG analysis.

1 Broader value chain| Adjacent markets also benefit from clean tech growth

Non-exhaustive

Machinery & equipment
Demand is expected to increase for hardware and electronic components, batteries, robotics, and finishing and testing services presenting a $4.7T opportunity in the US through 2040 (*see example*).

Construction & maintenance
Rebate programs[1] will accelerate residential construction (e.g. retrofits, energy upgrades), $3B in grants will support transportation infrastructure and hydrogen supply chain expansion

Raw materials
Clean tech will require raw materials, chemical, and energy input, e.g., increased demand for cobalt, lithium, ion, steel, aluminum for renewable energy generation.

Shipping and logistics
Redesigning supply chains to meet the needs of clean tech will require expansion of shipping routes and logistic services

Finance
IRA will stimulate development of new markets e.g., ability to sell unused tax credits will necessitate secondary markets for trading[1]

Agriculture & land use
IRA will accelerate demand for carbon markets which will stimulate investment in agriculture and land management

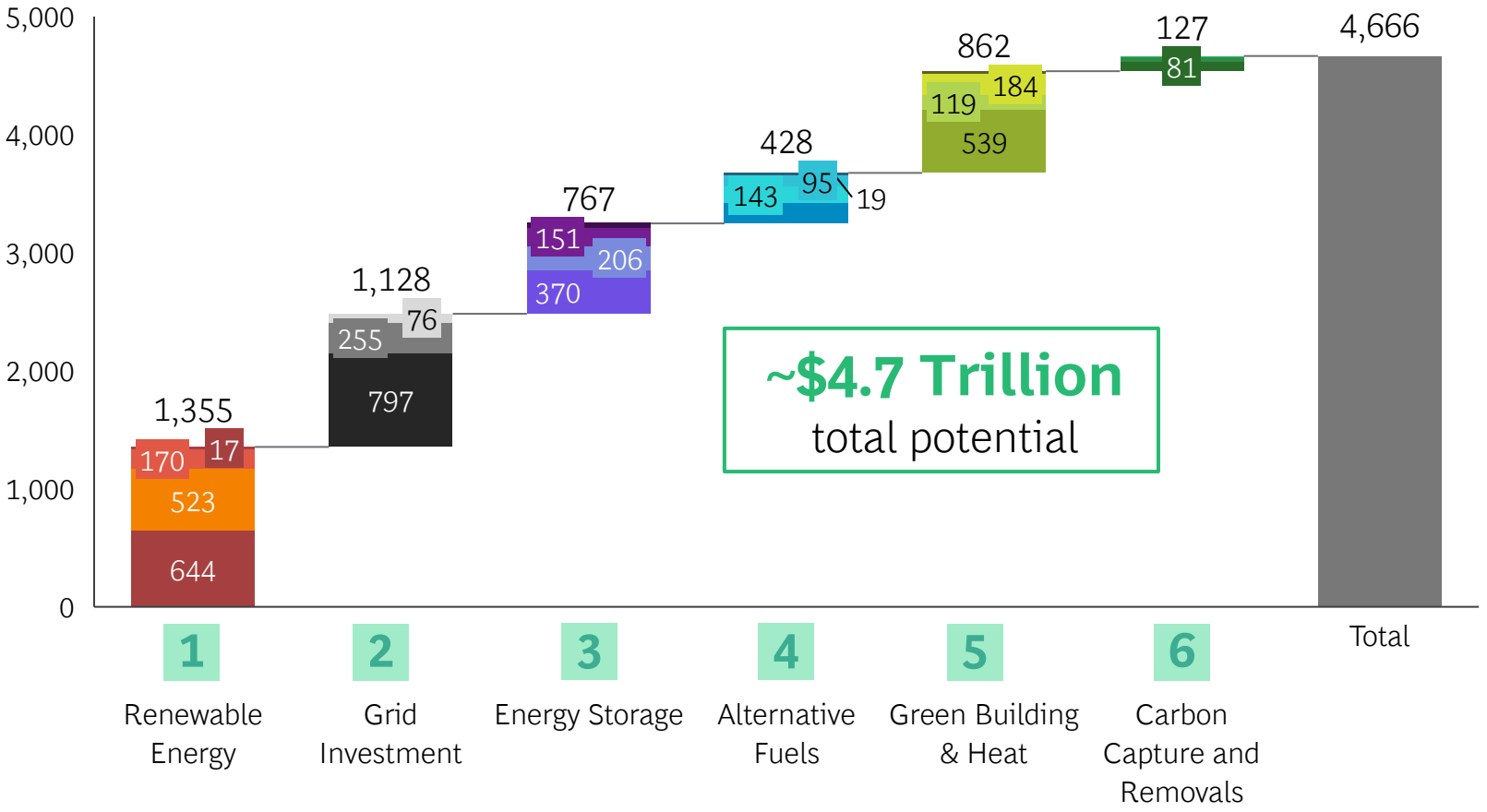
Education
Workforce development to upskill and train millions of workers for a clean tech economy will lead to require traditional training programs, trade apprenticeship, teaching materials, etc.

Professional services
Navigating a complex and uncertain transition will require lawyers, accountants, and other professional services

1. The High Efficiency Electric Home Rebate and Home Energy Performance-Based Whole-House Rebate
Source: Levelset; BCG analysis

1 Example | Clean technology machinery and equipment represents a US market opportunity up to $4.7T between now and 2040

Cumulative opportunity size for machinery makers 2020-40 ($B)



1	Renewable Energy	Wind
		Solar PV
		Others[2]
		Hydro
2	Grid Investment	T&D Upgrade
		EV Charging Infrastructure
		Smart Grid
3	Energy Storage	Off-highway BEV[3]
		Other[4]
		Stationary Batteries
		Battery Manufact. Equipment
4	Alternative Fuels	H2 Value Chain[5]
		Bio Fuels[6]
		Bioenergy
		Off-highway FCEV
5	Green Building & Heat	Heat Pumps
		CHP & Heat Optimization & Recovery
		Building Automation
		Electric Arc Furnace
6	Carbon Removal	Power gen. CCUS
		Industry CCUS
		Direct Air Capture

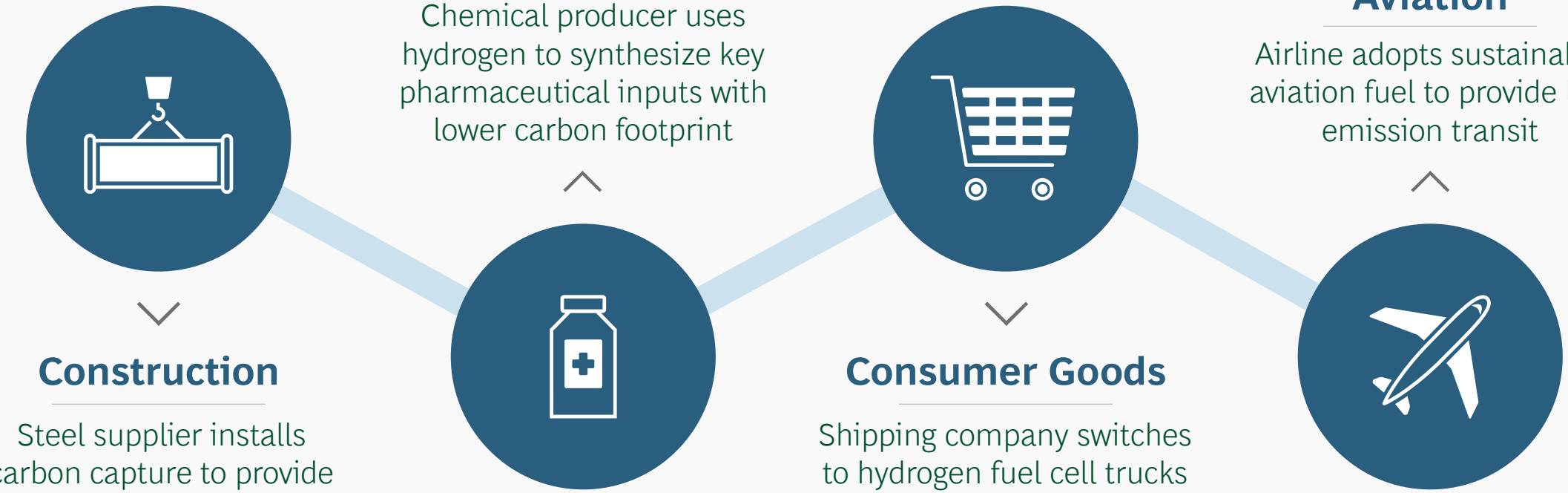
1. Includes converter stations, cables and other equipment for transmission and distribution upgrade 2. Geothermal and concentrated solar power (CSP) 3. On highway automotive batteries not included in this model 4. Includes battery manufacturing equipment market, thermo-mechanical storage, and pumped storage hydropower (PSH) 5. Includes mining, marine, construction, material handling, defense, rail and O&G 6. Includes H2 production, distribution & storage, conversion, transportation, iron & steel, existing feedstock, process power & heat, back-up & off-grid power

Note: Analysis not intended to be exhaustive

Source: BCG analysis

1 Low carbon products | Thousands of companies have committed to Net Zero targets; investment is needed to achieve ambition

New incentives can reduce cost to produce net-zero products for those industries,[1] for example:



Construction

Steel supplier installs carbon capture to provide construction company lower emissions steel

Pharma

Chemical producer uses hydrogen to synthesize key pharmaceutical inputs with lower carbon footprint

Consumer Goods

Shipping company switches to hydrogen fuel cell trucks for lower emissions deliveries of goods

Aviation

Airline adopts sustainable aviation fuel to provide low emission transit

1. For further details on the cost implications of the IRA, please see: Part 2 | US Inflation Reduction Act: Broader implications for corporate decarbonization

Note: SBTi (science-based targets initiative)

Source: SBTi; BCG analysis

2 Overcoming bottlenecks | Need to overcome near term obstacles to fully realize decarbonization

Obstacle	Regulatory clarity	Permitting, state/ local political challenges	Enabling infrastructure	Developing new supply chains	Resource availability	Workforce development
Proposed solutions	Federal rulemaking will be required to clarify critical attributes of the IRA in order to provide investment confidence	Multiple state and local government rules can block or delay infrastructure, especially for emerging technologies	Clean tech growth requires new and expanded infrastructure, including grid, pipelines, and storage	Significant new sources of value from sourcing domestic content and/or restructuring supply chains	Supply scarcity in critical minerals and components may require collaborative sourcing and new procurement models	Net zero transition requires 6.5M more skilled clean tech workers in US amid era of changing workforce dynamics
Example	Clarifying key rules and processes requires doubling of IRS staff[1]	**Deep dive into CCUS in following pages**	Developing hydrogen value chains will require significant deployment of storage and trucking infra.	Developing new li-battery sourcing to receive EV incentives and capture higher ITC incentives	Need for new procurement models to access to green H_2 electrolyzer capacity and components	**Deep dive into clean energy workforce in following pages**

Source: USA Fact "How will the Inflation Reduction Act change the IRS? – USAFacts," Accessed 9/15/2022, BCG analysis

2 Deep dive | Multiple regulatory barriers can hinder scalability of clean technologies

US Permitting process faces significant challenges

4+ years

Massive time investment (~4-16 years) to navigate long permit processes and increase community buy-in for clean energy, mining. Permitting time has doubled since 1970s

42%

Nearly half of clean energy ventures are **delayed by regulatory red-tape**, compared to just 15% in fossil fuel projects

50 states

Players must stay apace with **state-specific and fast changing regulations** to stay compliant in e.g., RES markets

*IRA provides **$350M** in funding for Permitting Council to improve permitting efficiency and predictability*

Example:

Scaling CCUS requires navigating challenging regulation

CCUS incentives

- **Outstanding clarity on IRS rules,** including qualifying facility criteria, "stackability" of credits, etc.
- **Multiple permit processes to own and operate CO_2 pipelines** to transport CO_2 for storage or utilization
- **Lagging product standards,** e.g., need years to evaluate performance and safety of CO_2-cured concrete for high mechanical strength applications[1]
- **Unclear verification of carbon footprint reduction,** e.g., from CO_2-derived building materials[1] complicates 45Q and IRA tax credit claiming

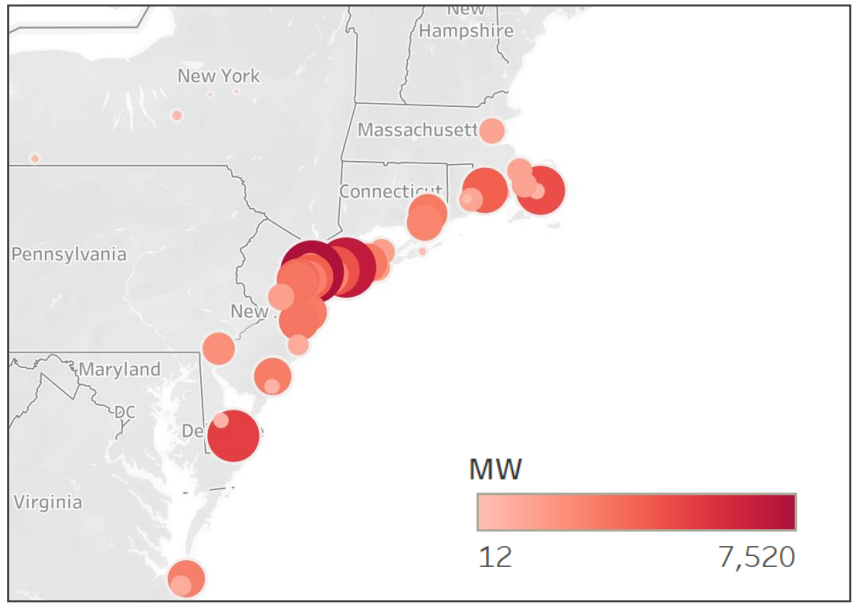
Carbon storage

- **EPA backlog** for underground injection (UIC) Class VI permits
- **Undefined legal rules on geologic pore-space ownership** & rights, including ownership pooling, in property documents
- **Long process to obtain pore space acess** requiring consensus from hundreds of landowners e.g., 60% landowner agreement in ND, 80% in MT, etc., where poor rights are defined
- **100-year post-injection liability** sharing negotiation between company and state

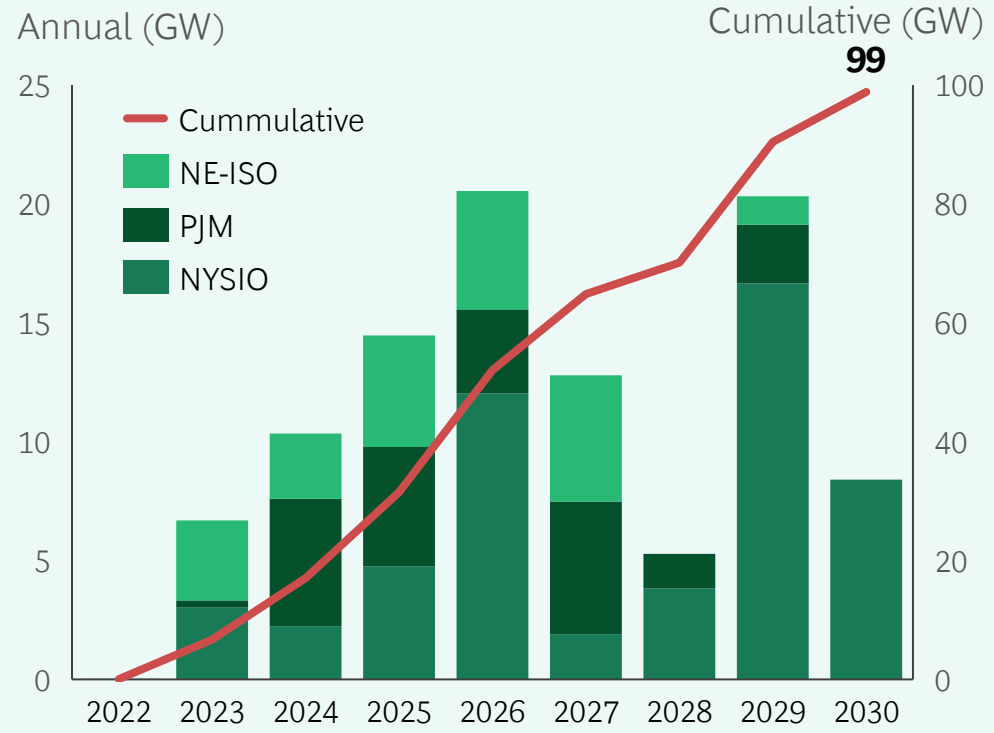
Source: Congress Passes Inflation Reduction Act | Permitting Dashboard (performance.gov); For the Inflation Reduction Act to work, the US needs permitting reform | The Hill; Permitting Reform Needed to Reach Clean Energy Goals (c3newsmag.com)

2 Deep dive | Interconnection ques are filling up, making it difficult for offshore wind (OSW) to identify and develop points of interconnection

Interconnection points being pursued on East Coast for OSW projects



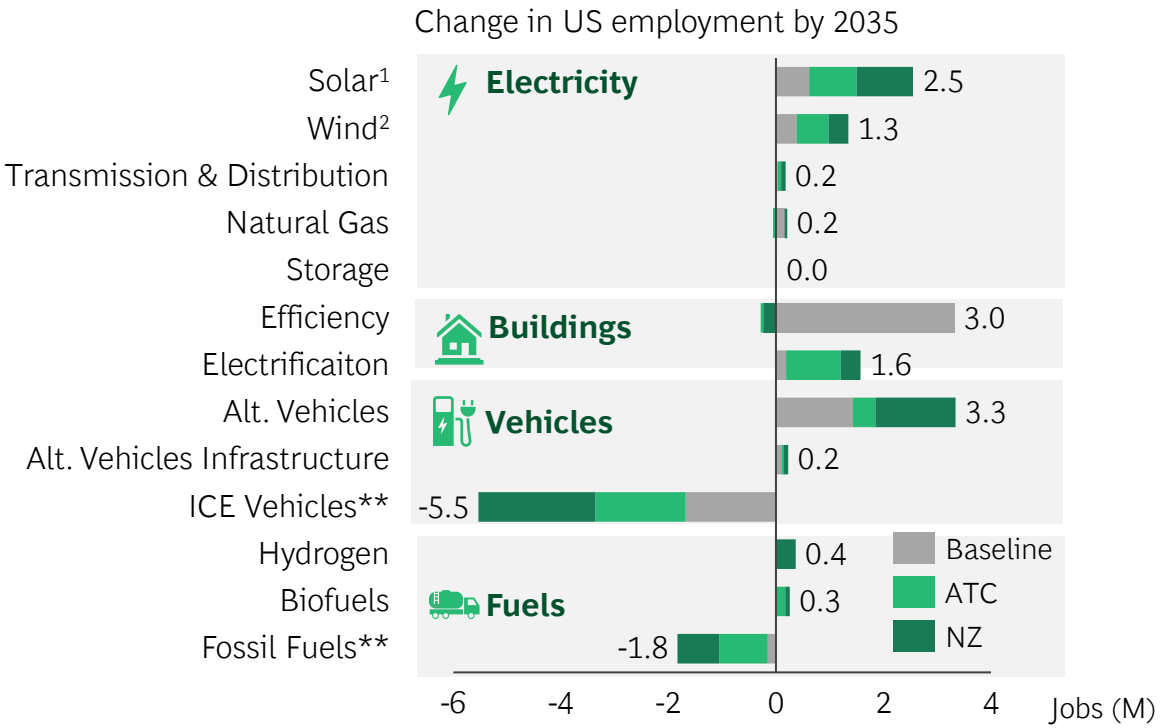
Capacity of interconnection requests made across PJM, NYSIO, and NE-ISO (MW)



Source: : PJM Interconnection Que; NYSIO Interconnection Que, NE-ISO Interconnection Que; HIFLD; BCG analysis

2 Deep dive| The transition to global Net Zero will require millions of jobs as America builds a clean energy workforce

6.5 million new jobs needed in US to achieve net zero



IRA accelerates expansion of American climate workforce adding 900k jobs

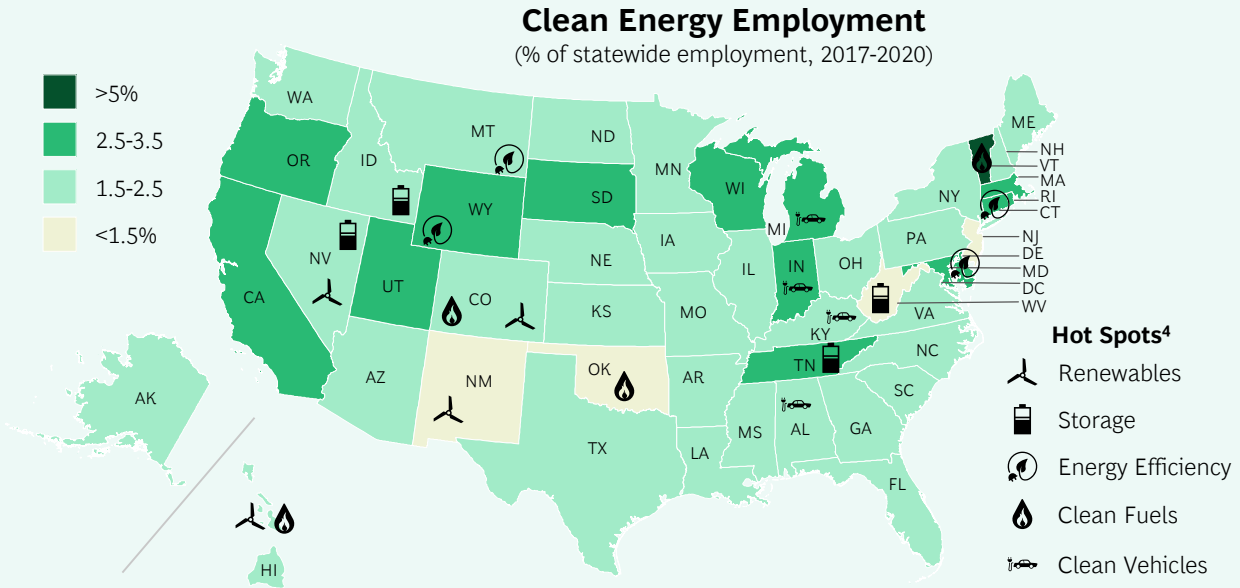
- Tax credits are tied to apprenticeship requirements
- $200 million to the Department of Energy establishes training to facilitate training

Clean workforce must grow despite changing skill landscape and differing regional strengths

US employees are quitting at levels higher than pre-pandemic levels

US skill supply or job preferences may not align with manufacturing demand

Certain regions already ahead on overall clean jobs

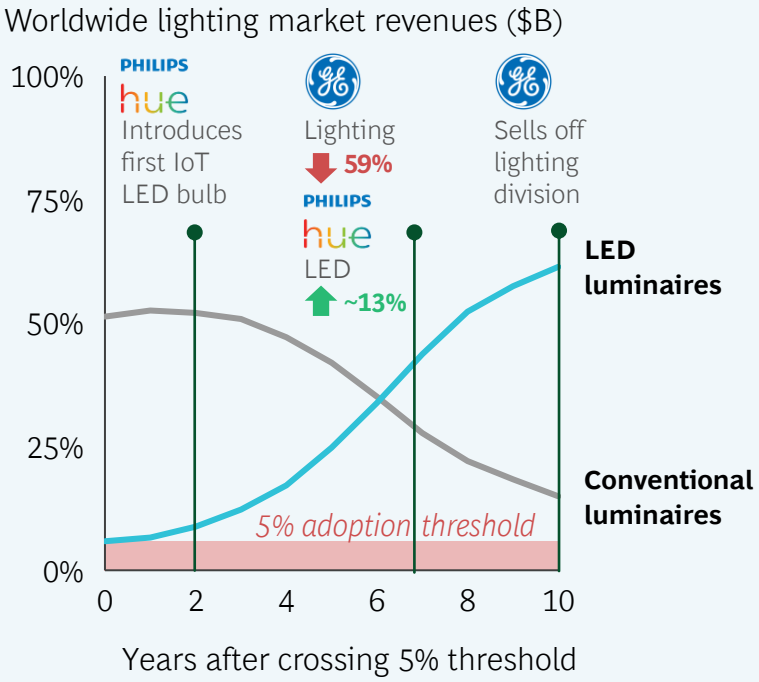


ATC = Advanced Tax Credit scenario NZ = Net Zero scenario.
1 Includes distributed and utility solar. 2. Includes onshore and offshore wind; IRA drives growth in onshore. 3. Combines residential and non-residential 4. Top 4 states by share of clean workforce
Source: World Resources Institute; World Energy Employment Job openings and labor turnover survey; Clean Jobs America 2021, E2; BLS includes non-farm industries; BCG analysis

3 The time to act is now| Incumbents that fail to embrace emerging trends risk being left behind

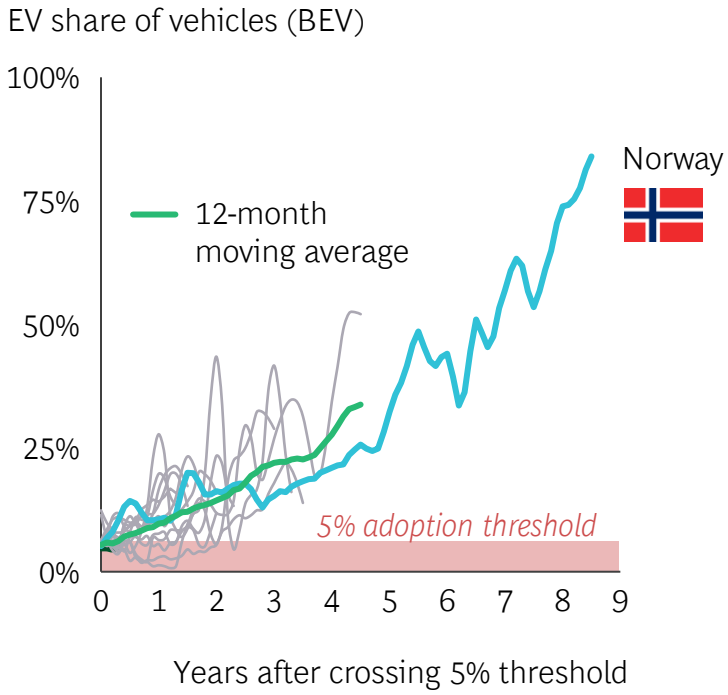
Adoption for new technologies follow "s-shaped" curve

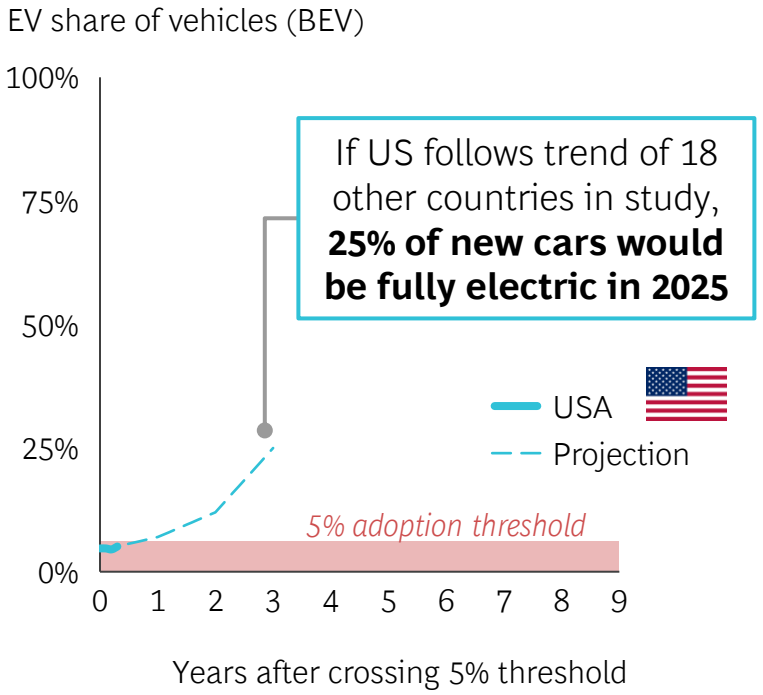
Example 1: Phillips gained competitive advantage through introduction of LED



Clean tech in the United States is reaching a tipping point for adoption as new technologies reach critical mass

Example 2. Electric vehicle penetration rapidly accelerated after reaching 5% penetration across the globe; US market recently crossed the 5% threshold and is positioned to follow suit

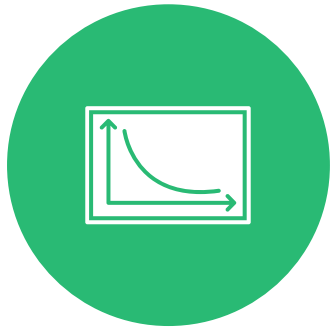




Note: LED electronics used in LED luminaires are included in the LED–luminaire market total; blue–collar services are excluded
Source: Energy.gov; A Turning Point for US Climate Progress, Rhodium Group; Philips Lighting Annual Report (2017); BCG 2020 lighting–market model; expert interviews; BCG model validated by 2019 Statista data; CNN Business; US Crosses the Electric-Car Tipping Point for Mass Adoption, Bloomberg

3 Securing competitive advantage | Business leaders must move quickly to secure scarce inputs needed for scalable sustainable business models

As funding floods clean tech, demand for sustainable resources, capabilities and infrastructure will outpace supply. Previously, we presented several ways to engage suppliers[1]:



Demand signals

- **Form coalition of peers**, including industry or tech coalitions and pooled procurement
- **Make advanced market commitments** to purchase specific tech

Strategic investments

- **Invest in specific partners**, via concrete volume agreements or other partnerships
- **Provide capital** with lower expected return

IRA and IIJA have provisions to bolster long-term resource availability

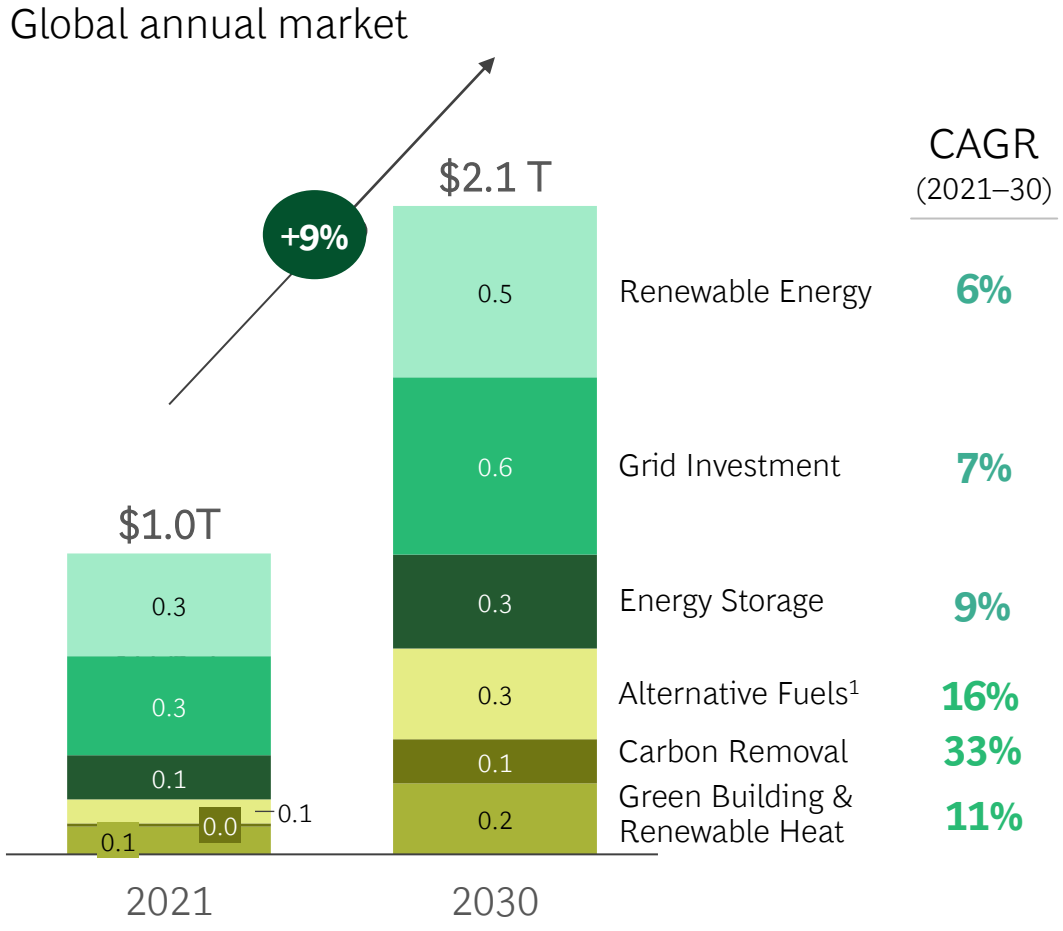
$3B green procurement funding increases market-competitiveness of domestic materials

Onshoring and building a domestic clean tech workforce will reduce geopolitically-induced scarcity

Previously cost-prohibitive alternative energy sources e.g., H_2 will increase clean energy supply

Source: Part 2 | US Inflation Reduction Act: Broader implications for corporate decarbonization

3 Securing competitive advantage | Strong growth expected across all tech sectors, but strategic approach must account for technological maturity



Two broad strategies to consider:

Mature technologies

Capturing opportunity in renewables and grid infrastructure requires making big bets to quickly build scale: leveraging existing capabilities to accelerate growth, orchestrating partnerships, or engaging in M&A.

Less mature technologies

Hydrogen, CCUS, and DAC face technological barriers, labor shortages, and unknown political climates. Strategies in this space will require testing and iteration to build new markets, and diversification to mitigate risks. Companies with competencies in related technologies will likely have a starting advantage.

1. Green Fuels not included in Alternative Fuels estimate due to limited data on annual growth
Source: BCG analysis

Further reading

Machinery

Net-Zero Trucks? Yes, It's Possible.

Why Electric Cars Can't Come Fast Enough

What It Will Take to Reap the Rewards of Renewable Fuels

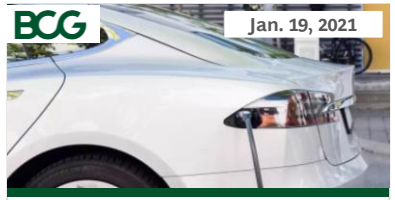
Digital & AI

AI Is Essential for Solving the Climate Crisis

Reduce Carbon and Costs with the Power of AI

Measuring Emissions Accurately

Finance



A $2T Banking Climate Opportunity Hiding in Plain Sight

Private Equity Should Take the Lead in Sustainability

Additional indirect clean tech market opportunities

Six Pitfalls to Avoid When Mobilizing for Sustainability

Aluminum Can Come Back Greener and Stronger

Global Shipping's Net-Zero Transformation Challenge

New Products

The Untapped Climate Opportunity in Alternative Proteins

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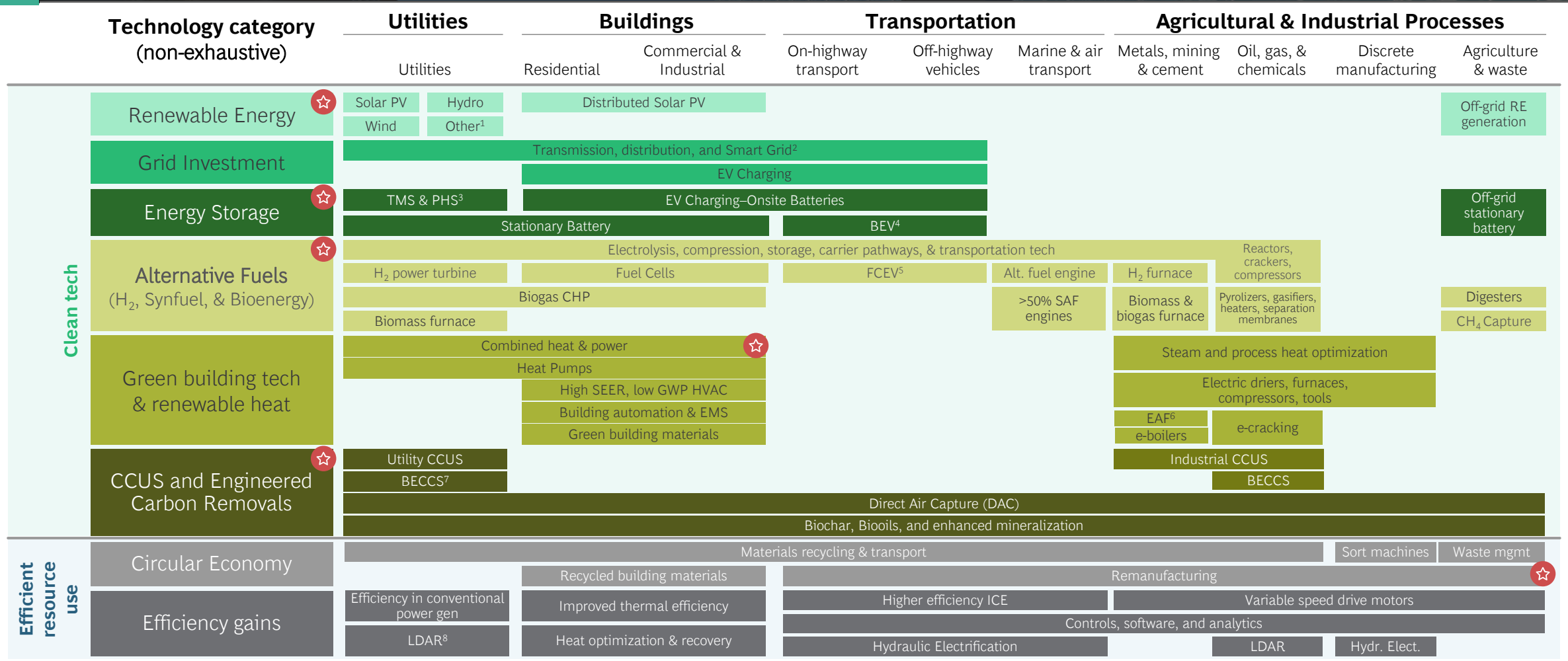
Appendix | Overview of technology landscape



☆ = Opportunities most benefitted by IRA … but full climate tech opportunity space expected to grow due to increased focus post-IRA

1. Includes geothermal and concentrated solar power 2. Includes converter stations, cables and other equipment for transmission and distribution upgrade; 3. Thermo-mechanical storage, and pumped storage hydropower; 4. Battery Electric Vehicle; 5. Fuel Cell Electric Vehicle; 6. Electric arc furnace; 7.Bioenergy with Carbon Capture and Storage; 8. Leak detection and repair. Additional mitigation equipment exists beyond LDAR. Source: BCG analysis

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