



BUILDING COMPANIES | TRANSACTIONAL RESEARCH

# 2021 Cleantech Innovation Hubs Survey Whitepaper

OCTOBER 2021

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10. Atlanta, GA

# ABOUT SEP

Saoradh Enterprise Partners (SEP) is a venture capital and research firm focused on technologies for disruptive sustainability across the nine sectors that comprise the cleantech ecosystem. SEP's approach is unique, leveraging its innovative market and technology research platform to identify sustainable technology opportunities in emerging cleantech hubs in the US for its investment funds and corporate clients. The SEP team partners with entrepreneurs, innovators such as universities and national labs, and leading corporations to build companies that disrupt valuable segments of supply chains for products that mitigate climate change and other environmental impacts.

To learn more about Saoradh Enterprise Partners, please visit [www.saoradh.com](http://www.saoradh.com).



7. Chicagoland - Chicago, IL

# UNTAPPED POTENTIAL FOR CLEANTECH

## AN INTRODUCTION

At Saoradh Enterprise Partners (SEP), we believe in the immense potential of clean technologies to create a sustainable future. However, this potential won't be fully realized unless we evaluate every innovation and harness the best technologies. Leveraging all cleantech ecosystems in the United States can optimize efforts to decarbonize the economy, reduce toxic emissions and resource consumption, and protect biodiversity and clean water — what we call *Solving Climate+ by 2050*.

The venture capital community is narrowly focused on the Bay Area, Boston, and NYC. However, our firm's experience in the northern Colorado Front Range (or, as we like to call it, the Clean Range) shows us that cleantech innovation is thriving in this and other regions.

SEP's inaugural Cleantech Innovation Hubs Survey provides insights into regional commercialization gaps and overlooked opportunities in cleantech. Based on key datasets for research funding and results, technology development, venture formation, and other metrics, SEP has developed what we believe to be the first and only comprehensive ranking of regional cleantech innovation in the United States. The Hubs Survey is our practical approach to guide our investment decisions and better orient our clients, the venture community, research institutions, entrepreneurs, media, policymakers, and other stakeholders of the hubs and cleantech in general.

# FELLOW CLEANTECH ADVOCATES,

In simple terms, why turn over just a few rocks to find cleantech opportunities when there are dozens of rocks available?

A corporate venture capital executive summarized the problem well on a visit to Colorado when he exclaimed, “We didn’t even know this stuff existed!” That sentiment has stuck with us ever since. What cleantech ecosystems in the US are relatively unknown to us — and the venture community at large — and need resources to thrive? The 2021 SEP Cleantech Innovation Hubs Survey is our attempt to find answers.

We can’t leave any rock unturned. Let’s understand each cleantech hub’s strengths and unique attributes, focus capital and other resources on them, and get our hands dirty building the best companies and commercializing the most impactful cleantech solutions where they sprout. We hope this survey helps you discover stuff you didn’t know existed.



**PAUL NELSON**

**FOUNDER & MANAGING PARTNER, SEP**

# WHY GEOGRAPHY MATTERS

We believe that the community where innovation arises and companies can be built is foundational to a startup’s success, capital efficiency, and the opportunity for accelerated product development. This is echoed by others, such as in the book *The Startup Community Way: Evolving an Entrepreneurial Ecosystem* and in the Brookings report “The Rise of Innovation Districts: A New Geography of Innovation in America.”

Our data suggests that instead of locating (or relocating) startups in expensive, highly competitive areas like Silicon Valley, investors should also focus on the emerging hubs where most of the cleantech innovation occurs and research, technology, and venture development engines can support cleantech commercialization.

27. Salt Lake City, UT

## HOW WE DEFINE CLEANTECH

Clean technology solutions improve environmental sustainability related to aggregate human welfare and functioning natural ecosystems. These technologies mitigate and transform existing industries and underpin emerging industries — *Solving Climate+ by 2050*. SEP segments cleantech into nine sectors, each with sub-sectors, technology groups, supply chains, applications, and keywords. Cleantech sectors are either an *emerging* industry or *transforming* or *mitigating* an existing industry.

## SEP Cleantech Sectors



# THE CLEANTECH COMMERCIALIZATION GAP

The charts on the next page show that venture capital is biased towards California, Massachusetts, and New York. Nearly three-quarters of venture capital funding is directed to these three states, while the reverse is true for innovation funding (represented here by university R&D expenditures). This creates a gap in the innovation-to-commercialization value chain, meaning promising cleantech outside CA, MA, and NY isn't reaching the market.

Looking at where venture capital is invested versus the location of venture-backed companies, we see that significantly more capital is invested per company in the top three hubs — indicating that investments in startups for the remaining 47 states are more capital efficient.

*While the gap for all industries and cleantech is similar, there is an imperative for change — at least for cleantech — for three reasons:*

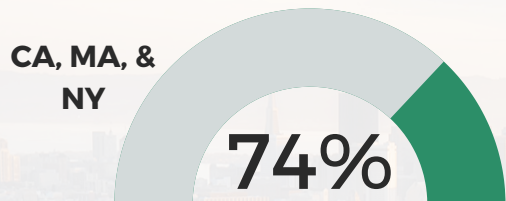
- The general tech innovation-to-commercialization system might be *working*, but that does not mean it's *optimal*.
- Unlike other industries (such as IT), cleantech involves ongoing technology development at research institutions, has long maturation times, and is prone to capital inefficiencies.
- Cleantech is time-constrained. We don't have time to overlook innovation wherever it occurs.

8. Seattle, WA

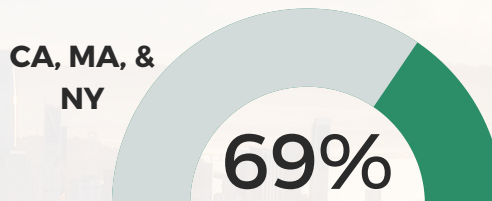


# All Industries & Verticals

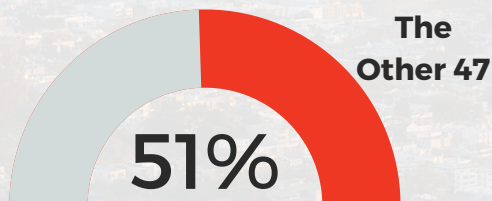
**74%** of US VC funding is invested in companies based in **CA, MA, and NY**. **26%** is invested in the other **47 states**.



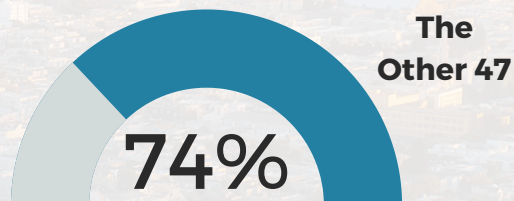
**69%** of VC funds AUM\* is domiciled in **CA, MA, and NY**. **31%** is domiciled in the other **47 states**.



**49%** of venture-backed companies are based in **CA, MA, and NY**. **51%** are based in the other **47 states**.

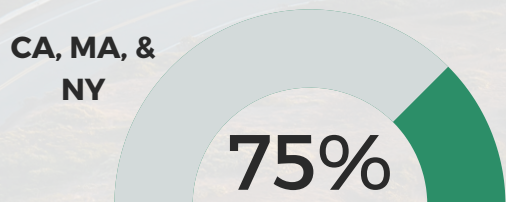


**26%** of university R&D expenditure is in **CA, MA, and NY**. **74%** is in the other **47 states**.

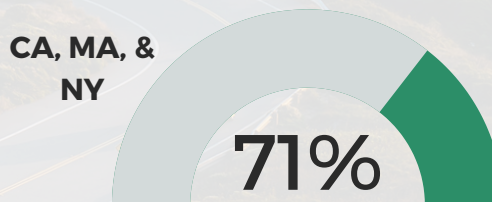


# SEP Cleantech Sectors

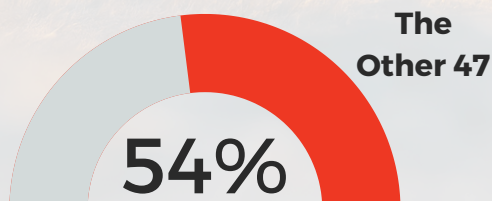
**75%** of US VC funding is invested in companies based in **CA, MA, and NY**. **25%** is invested in the other **47 states**.



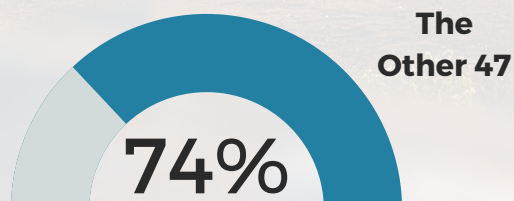
**71%** of VC funds AUM\* is domiciled in **CA, MA, and NY**. **29%** is domiciled in the other **47 states**.



**46%** of venture-backed companies are based in **CA, MA, and NY**. **54%** are based in the other **47 states**.



**26%** of university R&D expenditure is in **CA, MA, and NY**. **74%** is in the other **47 states**.



Sources: PitchBook Data, Inc., the US National Science Foundation, and Saoradh Enterprise Partners.

\*AUM is assets under management.

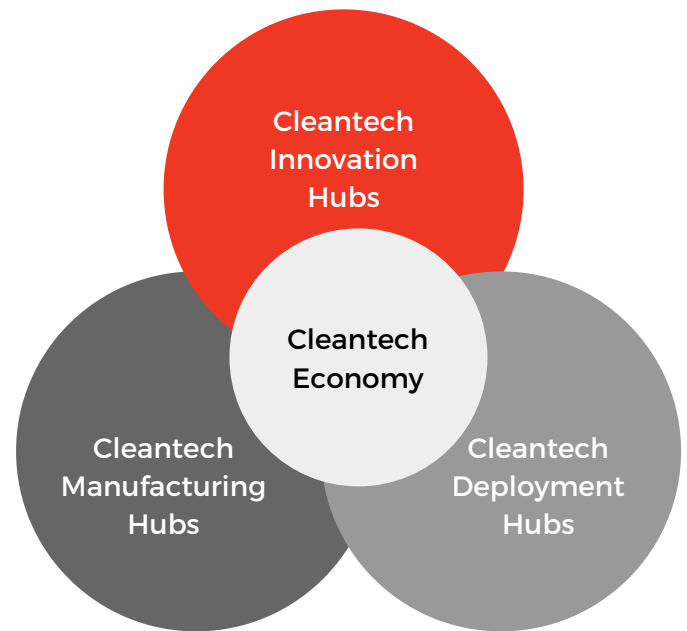


# WHAT IS A CLEANTECH INNOVATION HUB?

SEP defines cleantech innovation hubs as functioning regional ecosystems, typically one or more adjacent Metropolitan Statistical Areas (MSAs). A strong innovation hub includes well-funded research institutions, robust technology development, successful startups, and support infrastructure. The Hubs Survey indicates that today's emerging cleantech hubs need more company-building and other technology commercialization resources to reach their potential.

*Innovation* hubs are distinct from *manufacturing* and *deployment* hubs, but they can occur in the same region. While some important cleantech has been developed, such as silicon-based photovoltaics or large capacity wind power systems, much cleantech remains to be innovated and/or commercialized — or simply improved.

- Innovation hubs are where ideas originate and startups form (e.g., new solar panel tech).
- Manufacturing hubs are where the cleantech is built at scale (e.g., the solar panel production plants).
- Deployment hubs are where the cleantech is put to use (e.g., the solar panels are installed in an area with substantial solar resources).



## Innovation Hub

### Innovation Centers

Universities,  
institutes,  
national labs

### Stakeholders

State agencies,  
incubators/  
accelerators, investors,  
trade associations

### Companies

Startups, growth  
companies, F1000/  
G2000

# RANKING THE HUBS

*The Cleantech Innovation Hubs Survey is focused on the top 40 hubs and associated details based on datasets grouped into three silos: research funding and results, technology development, and venture formation.*

A total of 100 hubs were ranked from among hundreds of metropolitan areas evaluated. We analyzed dozens of datasets from third-party business intelligence platforms, federal agencies, and leading energy and economic development organizations and developed 13 final datasets that drive scoring and ranking of hubs. The Hubs Survey is intended to capture the score and rank (plus insights as separate data points) of the top hubs to guide the allocation of cleantech resources by investors and other stakeholders.

SEP's ongoing effort to separately conduct deep-mapping of selected emerging hubs should capture the details and nuances in a hub not available from national datasets as a further guidance tool.

## UNDERSTANDING THE TOP 40 HUBS

The data table on page 13 shows the base score and rank for each of the Top 40 Cleantech Innovation Hubs. In addition, the table shows four data points for each hub that provide the following insights:

- A hub's cleantech innovation activity without regard to its size of population.
- A community's culture of support and rewards for technology development by startups.
- Whether a hub is broadly or narrowly innovating in the cleantech space.
- Level of societal commitment to cleantech use and the environment for cleantech innovation.



# KEY TAKEAWAYS

- VC hotspots are impactful but just part of the story:** As expected, the top three cleantech innovation hubs are the Bay Area, Boston, and New York City. The value of these hubs is indisputable, but the factors that create a successful innovation hub — excellent research institutions, robust technology development, and a thriving culture of entrepreneurship and investment — are replicable in emerging regions.
- Cleantech is gaining momentum across the US:** Other hubs are already making a sizeable impact. Areas such as the Colorado Clean Range, D.C., Chicagoland, Seattle, and Atlanta have notable cleantech ecosystems and a high capacity for further growth. With the exception of the Bay Area and Los Angeles hubs, the general trend for the top 40 hubs is higher research silo and/or technology silo scores and lower venture silo scores — indicating that the former may be capital inefficient and are importing companies or tech.
- Each hub has different strengths:** We break down the scoring for each hub by silo (research funding, technology development, venture formation). By grouping the data this way, we see that some hubs score relatively well in the three silos, while others reached the top 40 based on an exceptional score in just one or two categories. This is especially true in the lower ranks but occurred for Baltimore, the Connecticut Innovation Corridor, and Knoxville in the top 20. A further differentiation by hub is seen through the lens of which of the nine cleantech sectors a hub ranked in the top 10 (see page 13).
- Small hubs shouldn't be overlooked:** We analyzed each dataset relative to the hub's employed population to offer an alternative scoring and ranking of the hubs based on cleantech intensity. This per capita analysis shows that some small hubs have exceptional innovation ecosystems, such as Ithaca, NY and College Station, TX.
- Areas with a strong initiative may not be ranked:** Some areas lacked sufficient representation in the datasets to be classified as a hub but are outstanding at innovating new technology or supporting startups. For example, the Elemental Excelerator in Hawaii and its cleantech startups represent a notable initiative.

# DEFINITIONS

The definitions for the primary column headers used in the Top 40 Cleantech Innovation Hubs table shown on the next page are as follows:

- **Score:** The total points for a hub out of a possible 1000 points (as described in the Hubs Survey Development Roadmap on page 19) determine the score.
- **Rank:** Relative position in the US among hundreds of hubs based on score.

**Insights:** These columns provide additional hub insights, but this data is not included in the score or rank calculations.

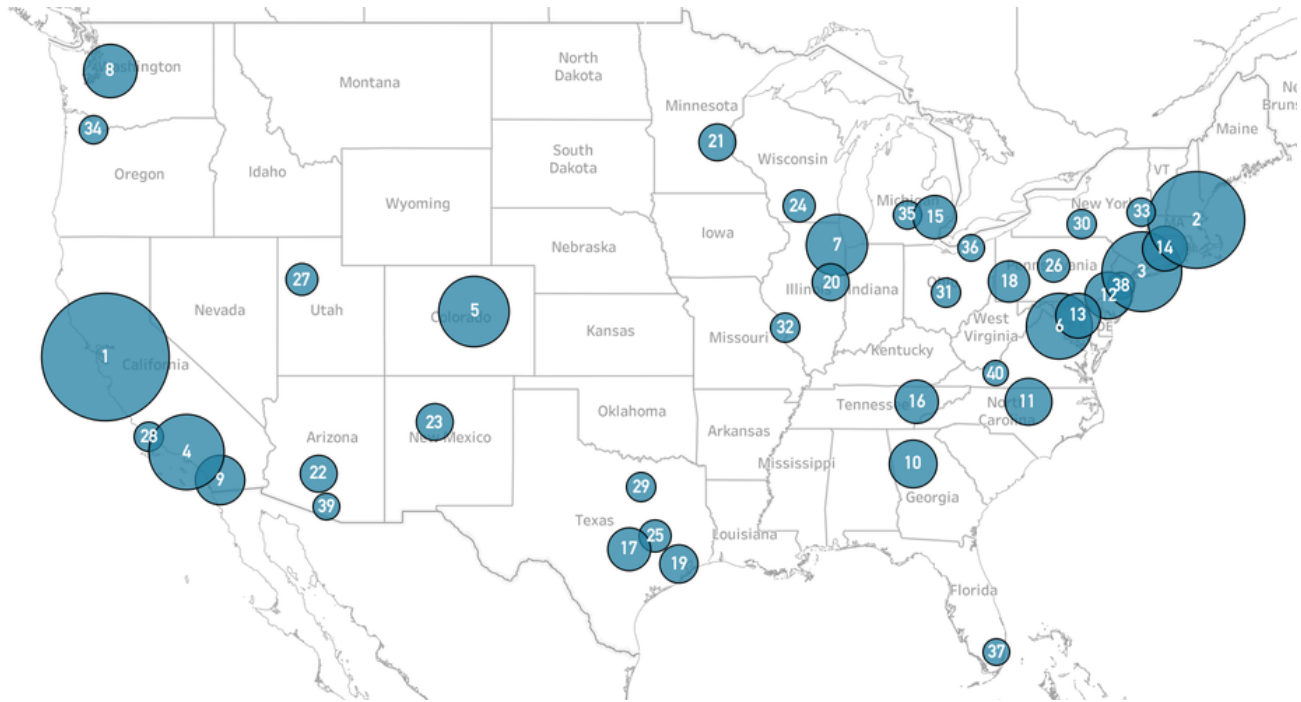
- **Cleantech Intensity:** Base score and rank adjusted on an employment per capita basis in a hub (just among the top 40 hubs).
- **Young Firm Index:** An index of 0 to 100 for Heartland Forward's overall young firm activity index, which combines their young firm knowledge intensity index and young firm employment share index, adjusted by SEP for MSAs covered by each hub. The young firm index is a measure of entrepreneurial ecosystems — ability to start and scale firms.
- **Ranked Top 10 in Sectors:** The number of SEP Cleantech Sectors in which the hub ranked in the top 10 by points.
- **State Cleantech (CT) Support:** An index of 0 to 100 for equally weighted state-level datasets: renewable energy jobs per capita employment and count of successful advanced energy legislation



# Top 40 Cleantech Innovation Hubs in the US

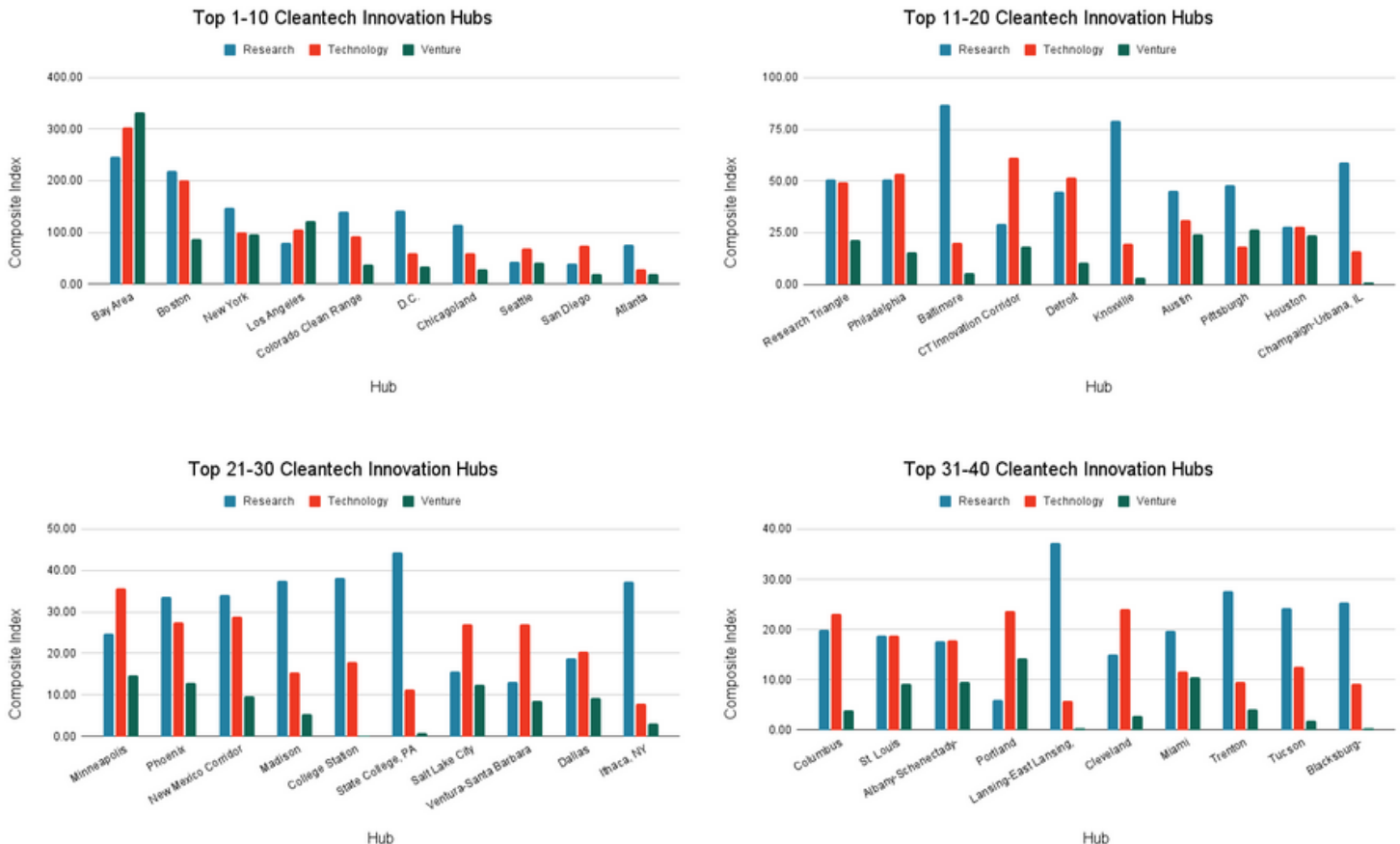
Hub Name	Rank	Score	Cleantech Intensity Rank	Young Firm Index	Ranked Top 10 in Sectors	State CT Support
Bay Area	1	884	2	100	9	100
Boston	2	508	5	95	9	39
New York	3	345	29	78	9	33
Los Angeles	4	308	21	74	9	100
Colorado Clean Range	5	270	15	59	9	56
D.C.	6	236	25	64	8	28
Chicagoland	7	204	32	54	8	27
Seattle	8	155	10	59	4	30
San Diego	9	133	12	65	2	100
Atlanta	10	124	36	51	1	6
Research Triangle	11	121	9	51	2	13
Philadelphia	12	120	31	52	5	1
Baltimore	13	113	30	47	0	47
Connecticut Innovation Corridor	14	109	19	62	4	12
Detroit	15	107	24	48	1	23
Knoxville	16	102	17	27	0	44
Austin	17	100	18	61	0	47
Pittsburgh	18	93	20	34	0	1
Houston	19	80	37	48	0	47
Champaign-Urbana, IL	20	76	4	34	0	27
Minneapolis	21	75	27	46	0	18
Phoenix	22	74	38	38	0	22
New Mexico Corridor	23	73	13	26	0	33
Madison	24	58	14	37	2	9
College Station	25	56	6	57	0	47
State College, PA	26	56	3	55	1	1
Salt Lake City	27	55	28	62	0	51
Ventura-Santa Barbara	28	49	16	84	0	100
Dallas	29	49	39	49	0	47
Ithaca, NY	30	48	1	38	0	33
Columbus	31	47	34	38	1	0
St. Louis	32	47	33	27	1	2
Albany-Schenectady-Troy, NY	33	45	11	43	0	33
Portland	34	44	22	55	1	45
Lansing-East Lansing, MI	35	43	23	33	0	23
Cleveland	36	42	35	31	0	0
Miami	37	42	40	68	0	11
Trenton	38	41	8	62	0	20
Tuscon	39	39	26	23	0	22
Blacksburg-Christiansburg, VA	40	35	7	40	0	53

### Top 40 Cleantech Innovation Hubs in the US



Source: Saoradh Enterprise Partners

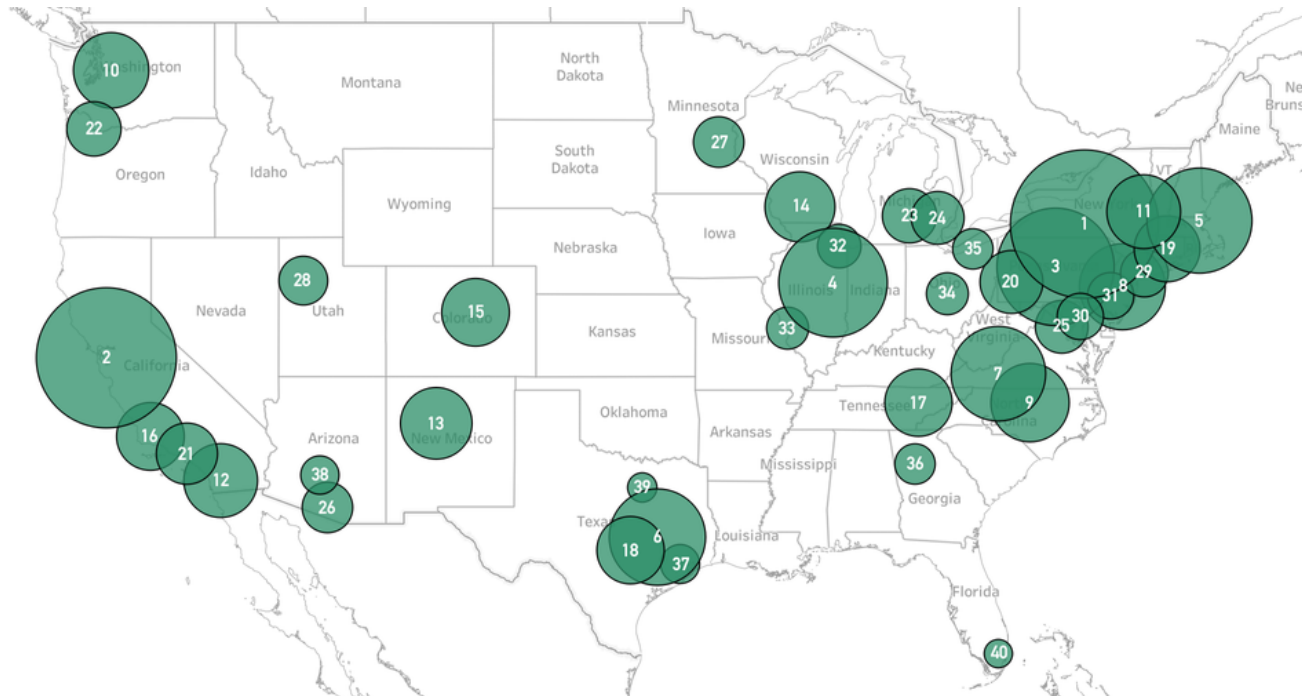
### Top 40 Cleantech Innovation Hubs - Scores by Silo



Note: Y-axis has a different scale for each of the four charts above to better show the data.

Source: Saoradh Enterprise Partners

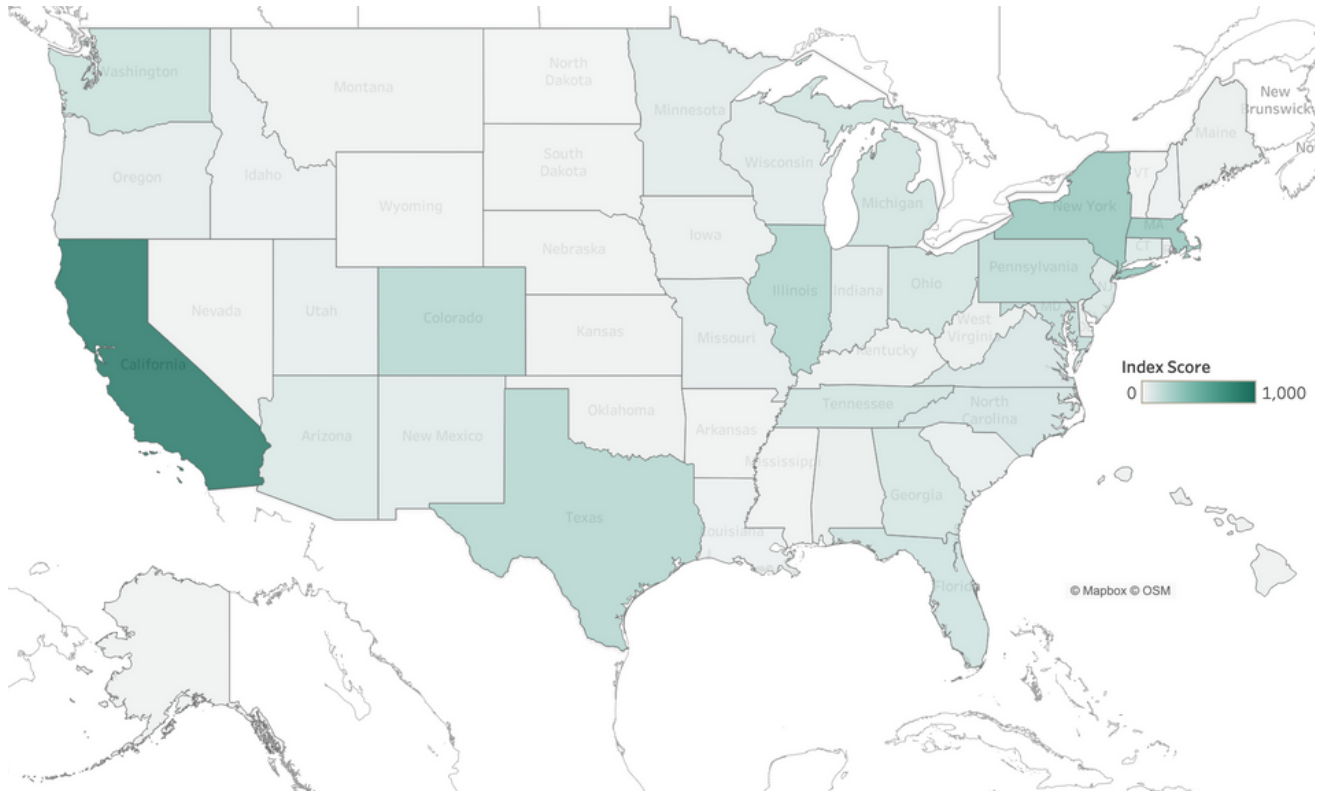
### Top 40 Cleantech Innovation Hubs by Intensity (per capita employed) in the US



Source: Saoradh Enterprise Partners

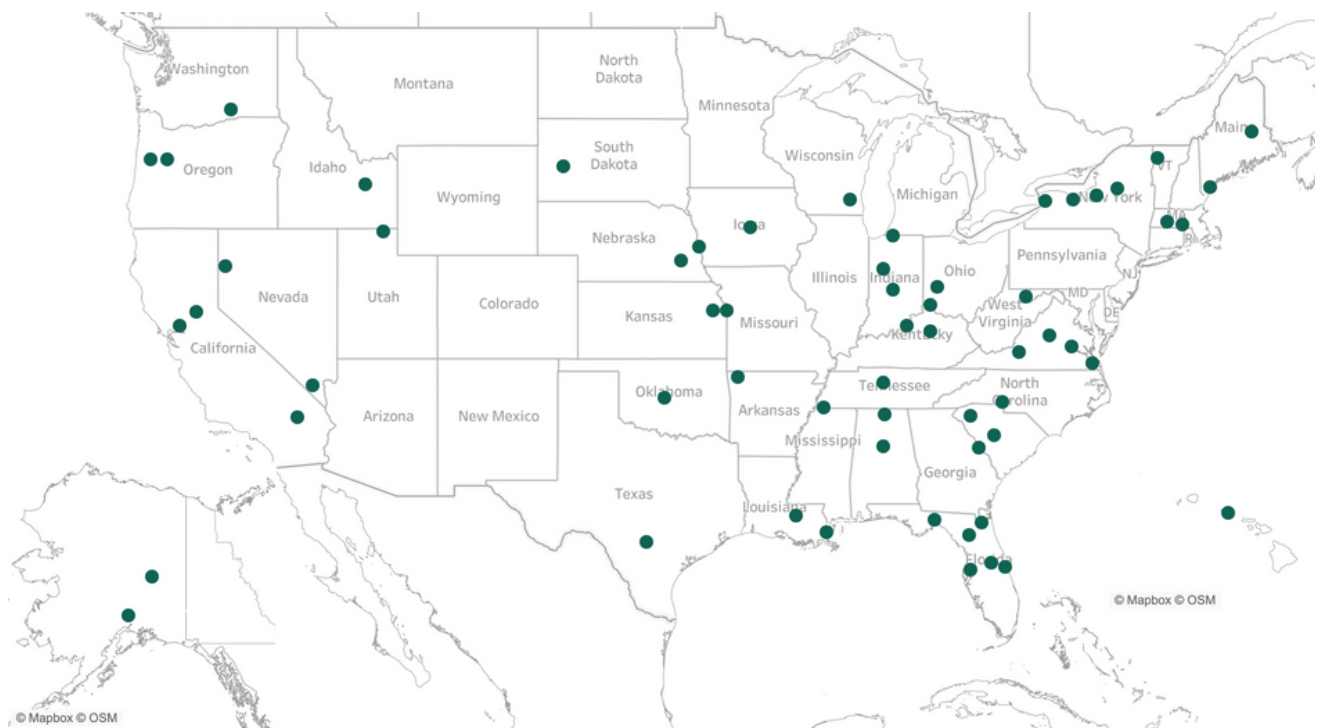
Hub Name	Metropolitan Statistical Areas (MSAs)	Hub Name	Metropolitan Statistical Areas (MSAs)
Bay Area	San Francisco-Oakland-Berkeley, CA; San Jose-Sunnyvale-Santa Clara, CA; Santa Cruz-Watsonville, CA	Minneapolis	Minneapolis-St. Paul-Bloomington, MN-WI
Boston	Barnstable Town, MA; Boston-Cambridge-Newton, MA-NH; Providence-Warwick, RI-MA	Phoenix	Phoenix-Mesa-Chandler, AZ
New York	New York-Newark-Jersey City, NY-NJ-PA	New Mexico Corridor	Albuquerque, NM; Los Alamos, NM; Santa Fe, NM
Los Angeles	Los Angeles-Long Beach-Anaheim, CA	Madison	Madison, WI
Colorado Clean Range	Boulder, CO; Denver-Aurora-Lakewood, CO; Fort Collins, CO; Greeley, CO	College Station	College Station-Bryan, TX
D.C.	Washington-Arlington-Alexandria, DC-VA-MD-WV	State College, PA	State College, PA
Chicagoland	Chicago-Naperville-Elgin, IL-IN-WI	Salt Lake City	Ogden-Clearfield, UT; Provo-Orem, UT; Salt Lake City, UT
Seattle	Seattle-Tacoma-Bellevue, WA	Ventura-Santa Barbara	Oxnard-Thousand Oaks-Ventura, CA; Santa Maria-Santa Barbara, CA
San Diego	San Diego-Chula Vista-Carlsbad, CA	Dallas	Dallas-Fort Worth-Arlington, TX
Atlanta	Atlanta-Sandy Springs-Alpharetta, GA	Ithaca, NY	Ithaca, NY
Research Triangle	Durham-Chapel Hill, NC; Raleigh-Cary, NC	Columbus	Columbus, OH
Philadelphia	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	St. Louis	St. Louis, MO-IL
Baltimore	Baltimore-Columbia-Towson, MD	Albany-Schenectady-Troy, NY	Albany-Schenectady-Troy, NY
CT Innovation Corridor	Bridgeport-Stamford-Norwalk, CT; Hartford-East Hartford-Middletown, CT; New Haven-Milford, CT	Portland	Portland-Vancouver-Hillsboro, OR-WA
Detroit	Ann Arbor, MI; Detroit-Warren-Dearborn, MI	Lansing-East Lansing, MI	Lansing-East Lansing, MI
Knoxville	Knoxville, TN	Cleveland	Akron, OH; Cleveland-Elyria, OH
Austin	Austin-Round Rock-Georgetown, TX	Miami	Miami-Fort Lauderdale-Pompano Beach, FL
Pittsburgh	Pittsburgh, PA	Trenton	Trenton-Princeton, NJ
Houston	Houston-The Woodlands-Sugar Land, TX	Tucson	Tucson, AZ
Champaign-Urbana, IL	Champaign-Urbana, IL	Blacksburg-Christiansburg, VA	Blacksburg-Christiansburg, VA

### US Cleantech Innovation Ranked by States



Source: Saoradh Enterprise Partners

### Next 60 Cleantech Innovation Hubs in the US



Source: Saoradh Enterprise Partners



# METHODOLOGY

## AN OVERVIEW

SEP analyzed many base datasets before choosing those to best represent the categories (or silos) of the cleantech value chain and other metrics. Taken together, the three silos define a foundation for a cleantech innovation hub: research, technology, and venture. To score and rank the cleantech innovation hubs, we defined the silos, other metrics (insights), and roadmap as shown on the next page. For scoring and ranking the states, the same three silos of research, technology, and venture were used.

SEP reviewed existing studies about cleantech development by region and technology development. These studies were not applicable to a comprehensive evaluation of hubs since they were limited (1) at the state level, (2) by scope constraints within specific networks, or (3) to all types of technology. However, these studies were informative to our thinking, and in some cases, the authors spent time with us to explain their findings. In particular, we would like to acknowledge two reports/groups for work in this field: “Perspectives from the IN2 Network: State of the Cleantech Landscape” by the National Renewable Energy Laboratory and “Regional Clean Energy Innovation: Regional factors for Accelerating the Development and Deployment of Climate Migration Technologies” by the Global Sustainability Initiative at the University of Maryland and Energy Frontiers Initiative. Other studies completely captured an important perspective to score hubs and became a source for the Hubs Survey.

### Research.

Federal, state, and other funding for universities and national labs indicate resources for cleantech innovation in specific geographic regions — and the likely interactions among organizations in such regions. Peer-reviewed publications are a signal of innovation in the field.

**Four datasets:** Cleantech-related NSF funding to universities and university R&D expenditures from NSF, DOE national lab budgets, and Wellspring’s list of publications.

### Technology.

Technology development funding at companies and research institutions shows a commercial pathway for cleantech. R&D expenditures by businesses signal an innovation culture and available talent. Patent issuances show that technology development is sufficient to fund IP protection.

**Four datasets:** Cleantech-related SBIR/STTR awards from SBA, ARPA-E awards from DOE, business R&D spending from NSF, and Wellspring’s list of filed and issued patents.

### Venture.

Venture capital funding into startups, counts of startups and employees, and VC funds AUM in a hub show venture development and capital availability. Accelerators and incubators with energy or climatetech activities indicate support to build startups.

**Five datasets:** Cleantech venture-related data from PitchBook Data, Inc., and accelerator/incubator data from the American Energy Society.

# SURVEY DEVELOPMENT ROADMAP

## 1. Identifying the Datasets

We started with over two dozen base datasets that could tell a portion of the story about innovation hubs. We focused on those datasets that captured a unique aspect of a hub and held multiple years of data at the city or MSA level. Using the SEP Cleantech Sectors system, we down-selected to base datasets that were part of the cleantech value chain or support an ecosystem. We defined each hub as one or more MSAs by the geographic extent of their functioning ecosystem.

1

## 2. Grouping the Data

We chose 13 base datasets after statistical and other analyses. These were divided into three silos: research, technology, and venture. The silos were each assigned 333 points since they represent the three equivalent segments of a cleantech value chain. SEP also developed a proprietary location sort tool to tie together cities and MSAs.

2

## 3. Scoring the Hubs

SEP's cleantech and geographic versions of the 13 base datasets were normalized and assigned an equal portion of the points allocated to their applicable silo. The sum of points for 13 datasets for a hub across three silos gave the total score out of 1,000, which determined the rank for a hub. A similar process scored states.

3

## 4. Additional Hub Insights

We identified additional datasets that were not appropriate for the quantitative scoring process for hubs but that investors and stakeholders could consider as adding insights to each of the Top 40 Cleantech Innovation Hubs. These insights include alternative hub ranks based on intensity (*per capita*), young firm activity, strength by cleantech sector (relied on just 9 of the datasets), and state cleantech support (based on policy and jobs).

4

## LOOKING FORWARD

**Year 2 and beyond.** The SEP 2021 Cleantech Innovation Hubs Survey is our inaugural survey. We believe it to be the first in-depth analysis of cleantech ecosystems across the United States. In addition to updating the Survey each year with new data and analysis, our team is systematically deep-mapping the top emerging cleantech innovation hubs.

**Your input matters.** For future surveys, we are looking for your input to continually improve the Hubs Survey's methods, sources, and features to represent the evolving landscape of cleantech innovation hubs. As such, we invite your comments and feedback on this Whitepaper.

## ACKNOWLEDGEMENTS

SEP gratefully acknowledges the sources for the base datasets and input provided to SEP in its process to prepare the Hubs Survey and this Whitepaper summary. In particular, we would like to thank the American Energy Society, ARPA-E (within the Department of Energy), Heartland Forward, the National Science Foundation, PitchBook Data, Inc., and Wellspring, whose staff spent considerable time working with the SEP team and many provided custom data sorts and files.

## AVAILABILITY OF THE SURVEY

The complete 2021 Cleantech Innovation Hubs Survey is available at no cost to subscribers of SEP's Innovation Flow Reporting service or limited partners in SEP investment funds and for a fee to other SEP corporate clients. The complete Survey contains additional discussion and takeaways, data and other information, statistical analysis, and associated observations. In addition, an interactive spreadsheet tool for use by SEP clients accompanies the Survey.

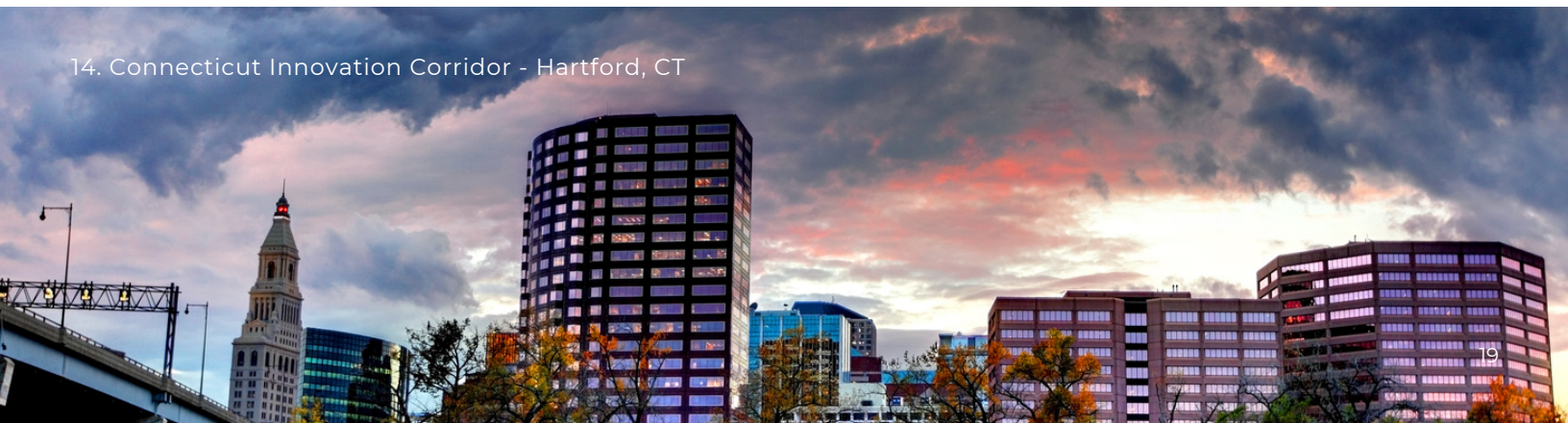
## SOURCES

Sources for base datasets used in the Hubs Survey include the American Energy Society, the Center for the New Energy Economy at Colorado State University, Heartland Forward, PitchBook Data, Inc., Wellspring, and numerous US federal agencies (the National Science Foundation, the Department of Energy, the Small Business Administration, the Census Bureau, and the Bureau of Labor Statistics).

**Note 1:** SEP developed the final cleantech datasets relying in part on data from the sources listed above. The final datasets drive the scoring, ranking, insights, and charts shown in this Whitepaper and the complete Hubs Survey. The final datasets, associated outputs, and the Hubs Survey and Whitepaper were not prepared or reviewed by the sources for the base datasets.

**Note 2:** SEP clients can refer to the complete 2021 Cleantech Innovation Hubs Survey for a detailed list and description of sources and methods. These include time-frames for each dataset, cleantech and geographic sort methods, descriptions of the databases, reports and tables, links to the base dataset sources, and other relevant information.

14. Connecticut Innovation Corridor - Hartford, CT



# RESEARCH FORWARD

## Research Forward Platform

We've created services synthesizing SEP's unique tools and systems (Innovation Hubs, Cleantech Sectors, and Green Metrics) with information from top business intelligence platforms and other third-party sources (which comprise our Datalab). We created these resources based on the deep industry knowledge, critical analysis, and investment-centric lens of the SEP team. Our research platform helps you enhance your innovation program, make informed cleantech investments, and develop new cleantech products. We know it works because we use it to build companies.

## Innovation Flow Reporting (IFR)

Our IFR service is designed to illuminate innovation hubs and identify and capture the best cleantech commercialization opportunities for corporate clients. SEP's Innovation Hubs tool and Datalab (with access to leading third-party business, technical, and market databases) drive the deliverables for our clients. SEP also tracks Megatopics, which are technologies and markets with substantial environmental benefits and investment potential. We use the SEP Cleantech Sectors and Green Metrics systems to organize and prioritize our data. IFR generates new opportunities by connecting corporate innovation programs, R&D departments, CVC offices, and open innovation initiatives to a rich cleantech ecosystem.

## Tools & Systems



INNOVATION HUBS



CLEANTECH SECTORS



GREEN METRICS

## SEP Services



INNOVATION FLOW REPORTING



PRACTICE AREAS



TAILORED ENGAGEMENT SERVICES



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