



BOSTON CLEANTECH

report and analysis of the
Boston cleantech sector





“At swissnex Boston, we have long recognized the importance of addressing environmental concerns head on. We believe the entrepreneurial spirit, as well as careful research, is the best way to make a meaningful contribution to global issues.

Cleantech is an important piece of the puzzle – one that has tremendous potential in both the near and long term. In this report, we strive to highlight our learnings from the local Massachusetts ecosystem and provide a glimpse into the future for both Switzerland and the United States.”

- Alicia Evangelista
Head of Innovation+, swissnex Boston



CLEANTECH

HIGHLIGHTS IN GREATER BOSTON

Boston is a global hub for cleantech innovation and entrepreneurship, home to some of North America's largest cleantech incubators, and a large number of VC firms specializing in cleantech investments. Massachusetts has more cleantech companies (per capita) than any other US state, and in 2019 and for the ninth year in a row, Massachusetts was named the most energy efficient state in the US.

JOBS



The **number of jobs** in the Boston clean energy industry has **nearly doubled** over the last decade.

RESEARCH



Greater Boston boasts **60+ universities and colleges**, including MIT and Harvard University.

FUNDING



Over the last 3 years, **\$2.8B in venture capital (VC)** has been invested in Boston cleantech startups – approximately 10 times the amount of VC invested in Switzerland. Many VC firms now include sustainability among their investment criteria for startups.

STARTUPS



On average, **14 new cleantech startups** are founded in the Boston area each year. Notable startups include Sense, Indigo, Commonwealth Fusion Systems, VIA, Bevi, and Form Energy.

SUPPORT SERVICES



Boston is home to a large number of co-working spaces, accelerator programs and incubators **exclusively for cleantech startups**. State-of-the-art incubators such as Greentown Labs and The Engine provide labs, specialized equipment, capital, knowledge and a network to cleantech startups.

CLEANTECH TRENDS



Local cleantech experts see **solar power, wind power and building electrification** (heat pumps, etc.) as some of the most promising technologies in the short term. **Carbon capture and storage (CCS)**, on the other hand, is expected to be most promising in the long term.





TABLE OF CONTENTS

SWISSNEX BOSTON	6
WHO WE ARE	6
WHAT WE DO	6
WHAT IS CLEANTECH?	7
WHY CLEANTECH IS NEEDED MORE THAN EVER	7
WHY BOSTON AND THE US?	9
STARTUPS	12
FUNDING	13
KEY DRIVERS AND CHALLENGES	14
OUTLOOK	15
CLEANTECH IN A POST-PANDEMIC WORLD	17
THE CLEANTECH STARTUP ECOSYSTEM IN BOSTON	18
INCUBATORS	18
ACCELERATORS	19
FUNDING SOURCES	20
COMMUNITIES AND NETWORKS	22
ACADEMIC INSTITUTIONS	24
ACADEMIC INITIATIVES	26
REGULATORY ENVIRONMENT	27
NOTABLE CLEANTECH STARTUPS IN BOSTON	28
REFERENCES	30



swissnex Boston

Who We Are

swissnex Boston is the Swiss Consulate for Education, Research and Innovation based in Cambridge, Massachusetts. Initiated by the State Secretariat for Education, Research and Innovation (SERI) and managed in cooperation with the Swiss Federal Department of Foreign Affairs, swissnex Boston is a public-private venture that represents the best of modern science diplomacy. swissnex Boston is part of Switzerland's swissnex network with offices in San Francisco, Shanghai, Bangalore and Rio de Janeiro. In 2013, swissnex Boston inaugurated a satellite office in New York City, known as swissnex in New York. Figure 1 shows the global swissnex network which includes all five swissnex locations and their outposts, as well as the 20+ Science and Technology Offices (STO) and Counselors (STC) based in Swiss Embassies around the world.



Figure 1: Global swissnex network

What We Do

Our mission is to support the outreach and active engagement of our partners in the international exchange of knowledge, ideas and talent. The main tasks of the swissnex network consist of:

- Connecting its partners to thriving innovation ecosystems worldwide,
- advising on trends and opportunities in science, education and technology,
- promoting the visibility of Swiss higher education and research institutions, startups and other innovation-driven partner organizations,
- inspiring new ideas by promoting knowledge exchange.

swissnex Boston is active in the following three focus areas:



swissnex Boston therefore collaborates with a broad spectrum of partners from higher education and research institutions, governmental institutions, startups and innovation driven companies, non-governmental, non-profit organizations and creative industries linked to science.



What is Cleantech?

Cleantech, which stands for clean technology, covers those products and services that reduce negative environmental impacts while still providing superior performance at lower costs. Cleantech should therefore be competitive with, if not superior to, its conventional counterparts while minimizing the negative effects on the environment. Although the cleantech sector is very interdisciplinary, it can be divided into the following six segments:



Renewable energy production, storage and distribution

- Renewable energy technologies (e.g. photovoltaics)
- Energy storage solutions (e.g. batteries)
- Energy transmission and distribution (e.g. smart grids)

Energy efficiency

- Building design and envelope
- Building control and automation (e.g. smart meters)
- Heating, ventilation, air conditioning, water heating
- Appliances and lighting



Sustainable food

- Sustainable agriculture and organic farming
- Reducing food waste
- Plant-based diets and lab-grown meat

Sustainable transportation

- Electric vehicles and alternative fuels
- Autonomous vehicles and ridesharing
- Integrated mobility systems and infrastructure



Resource efficiency

- Circular economy
- Reducing waste and resources used
- Advanced materials

Sustainable finance

- Impact investing and microfinance
- Green bonds
- Green lending



Why Cleantech is Needed more than Ever

Cleantech entrepreneurs and companies are developing solutions to solve our biggest environmental challenges, which have never been greater or more complex. Among the most pressing issues facing the planet and people are:

Global warming: Global warming describes the ongoing heating of Earth's climate system observed since the pre-industrial period due to human activities, primarily the emission of greenhouse gases (GHG). Anthropogenic GHG emissions have already led to an average global warming of 1 °C, which has increased the frequency and intensity of natural disasters such as droughts, floods, wildfires, cyclones and heat waves [1]. According to the Intergovernmental Panel on Climate Change (IPCC), global warming must be restricted to 1.5 °C in order to avoid severe and irreversible impacts. To achieve this, GHG emissions must be reduced to net zero globally around 2050 (also known as carbon neutrality), which means that global GHG emissions must be reduced by 50 % by 2030. We are therefore in the critical decade: rapid and far-reaching decarbonization in every economic sector is required.

Plastic pollution: The production of plastic has grown dramatically and reached almost 400 million tons in 2016 as plastic is cheap, reliable and versatile [2]. However, these advantageous properties also support the development and use of disposable plastic products: Almost half of newly produced plastic



is only used once and becomes waste in less than three years. According to current estimates, one third of plastic waste ends up in the environment as land, fresh water or marine pollution. Plastic pollution not only kills wildlife and damages natural ecosystems but also affects humans, who are increasingly likely to ingest microplastics by consuming contaminated foods. The full effects of microplastics on humans and the natural world are still unknown.

Overfishing: In 2015, one third of marine fish stocks were overfished, while large fish are much more affected: at least two thirds have already been removed [3]. Overfishing is not only destroying ocean ecosystems but also threatening food security for hundreds of millions of people worldwide [4].

Deforestation: 420 million hectares of forest have been lost globally since 1990 – more than twice the area of Mexico – and deforestation is continuing at an alarming rate [5]. Every day, a rainforest area nearly 14 times the size of Manhattan is burned around the world. Deforestation contributes significantly to climate change, aridity and the ongoing loss of biodiversity. The main driver of deforestation is agricultural expansion, especially for cattle ranching, soybean and oil palm cultivation.

Air pollution: According to the World Health Organization (WHO), seven million people die due to air pollution every year [6]. Air pollution increases mortality from stroke, heart disease, lung cancer, acute respiratory infections and other diseases. In 2016, 91 % of the world population, i.e., nine out of ten people, lived in places with polluted air (where WHO guidelines were not met). In many cities, such as Los Angeles, air pollution causes smog. Among the main anthropogenic sources of air pollution are fossil fuel power plants, vehicles with an internal combustion engine, heating and cooking. Typical pollutants are particulate matter (PM), ozone (O₃), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂).

Water scarcity: Water scarcity, either due to scarcity in availability (physical water scarcity) or due to scarcity in access (economic water scarcity), already affects more than two billion people worldwide [7]. Inadequate sanitation leads to diseases, such as cholera and typhoid fever, which kill two million people, mostly children, every year [8]. Major drivers are agriculture and climate change, and the situation will rapidly get worse at the current consumption rate. According to existing climate change scenarios, up to 700 million people will be displaced by water scarcity by 2030 [9].

Unfortunately, people living in poverty in developing countries will be (and already are) the first and worst affected by most of these key challenges. Developing countries are not only the most impacted but also the least able to afford its consequences. Their vulnerability is due to a number of different factors, such as socio-economic and governance factors and often vulnerable geographies that limit their ability to prevent and respond to the impacts of major environmental issues. It is therefore not surprising that cleantech contributes to the achievement of (at least) 7 of the 17 Sustainable Development Goals (SDGs).¹



1. The 17 SDGs are the goals for the 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015. The SDGs are designed to sustainable, peaceful and prosperous future for people and the planet.

Why Boston and the US?



The United States

- **the country with the best entrepreneurial ecosystem** according to the Global Entrepreneurship Index (GEI) which is based on 14 different indicators, including the entrepreneurial attitudes of the local population, risk capital, education and the available infrastructure [10].
- **home to the largest, oldest and most developed cleantech innovation ecosystem in the world** [11].
- **the birthplace of 51 of the top 100 cleantech startups in the world.** In 2020, the Cleantech Group determined the 100 private companies (from over 8,000 companies and 80 countries) most likely to make a significant market impact over the next five to ten years. 51 of them came from the US [12].

Massachusetts

- **the first nationally in utility and tech patents granted per capita** [13].
- **the leading technology state in terms of innovation** (see Figure 2) [13].
- **has more cleantech firms than any other state** (per million population) (see Figure 3) [14].

Boston

- **the number one global innovation hub** according to Hickey & Associates [15].
- **consistently in the top ten of the most innovative cities in the world** [16].
- **more innovative than San Francisco-San Jose and Zurich**, according to the Innovation Cities Index [16].
- **third in the world for venture capital investments** (see Figure 4) [17].
- **the number one US city for clean energy in 2019** for the fifth time in a row [18].



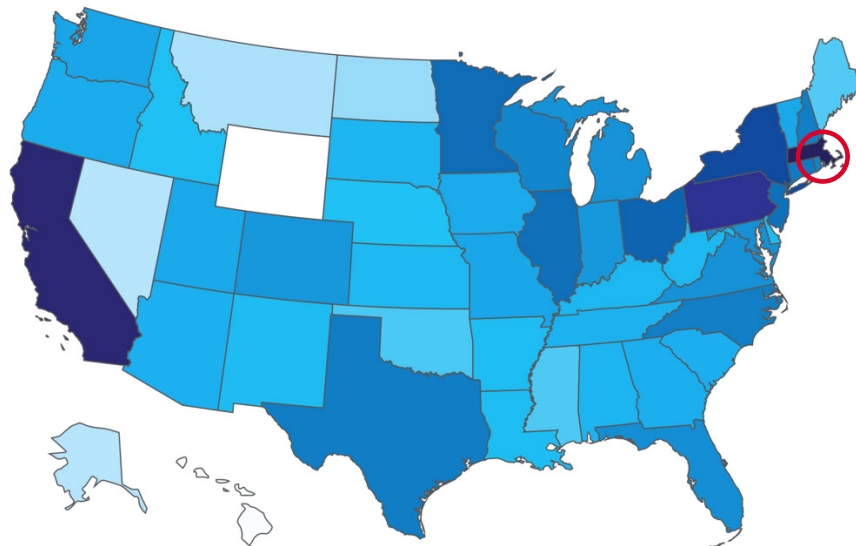


Figure 2: Level of innovation in US states (darker = more innovative) [13]

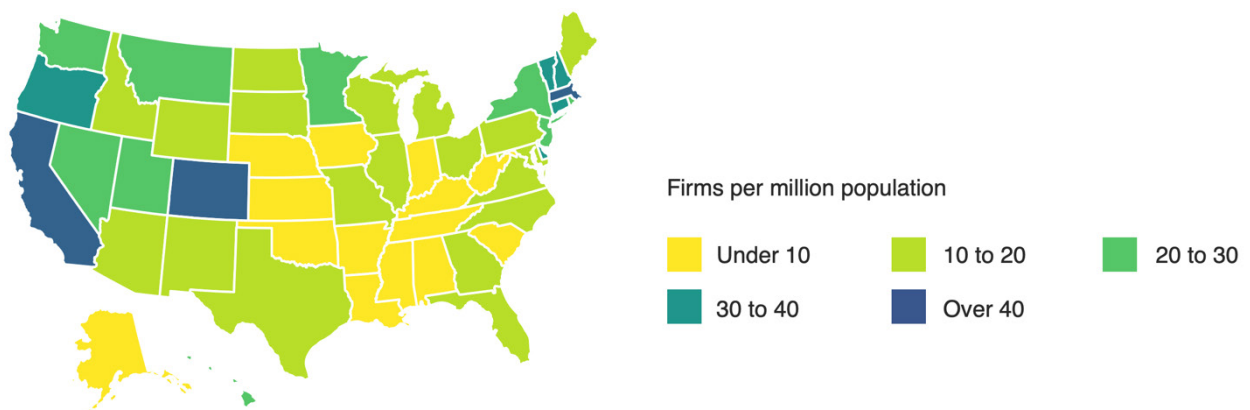


Figure 3: Cleantech firms per million population [14]

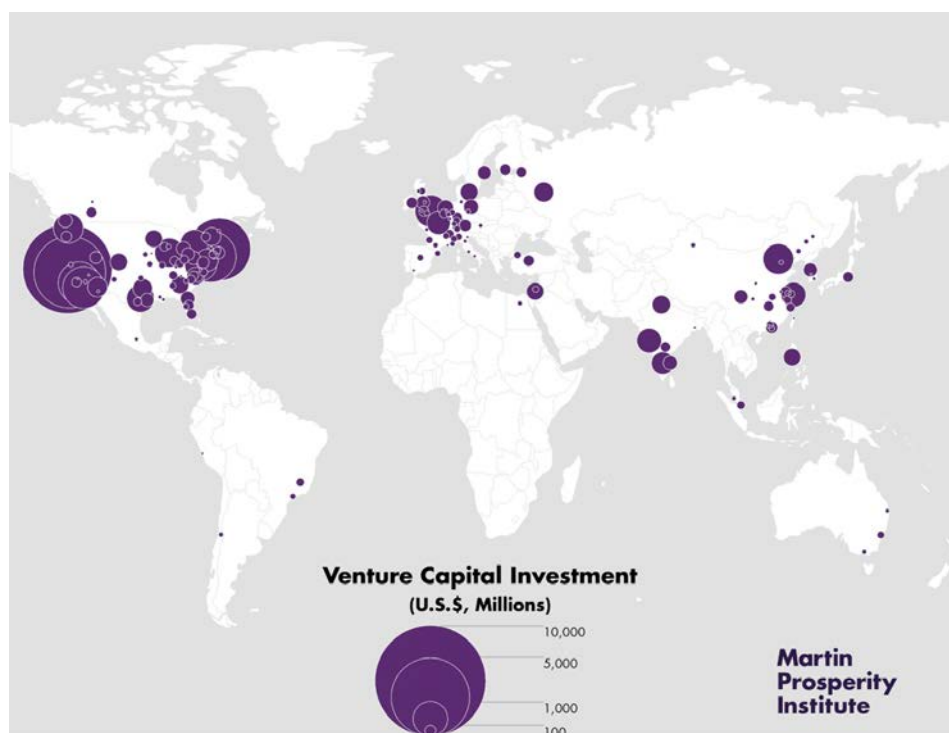


Figure 4: Global venture capital investment [17]

Industry Size and Growth

Figure 5 shows how the number of cleantech jobs in Massachusetts has increased over the last decade [19].² Since 2010, the cleantech industry in Massachusetts has increased by 86 %. The added jobs account for 11.5 % of all jobs created in the state during that time, although cleantech jobs only account for 3.1 % of all jobs in Massachusetts. This clearly shows that the cleantech industry has grown much faster than the rest of the economy in Massachusetts.

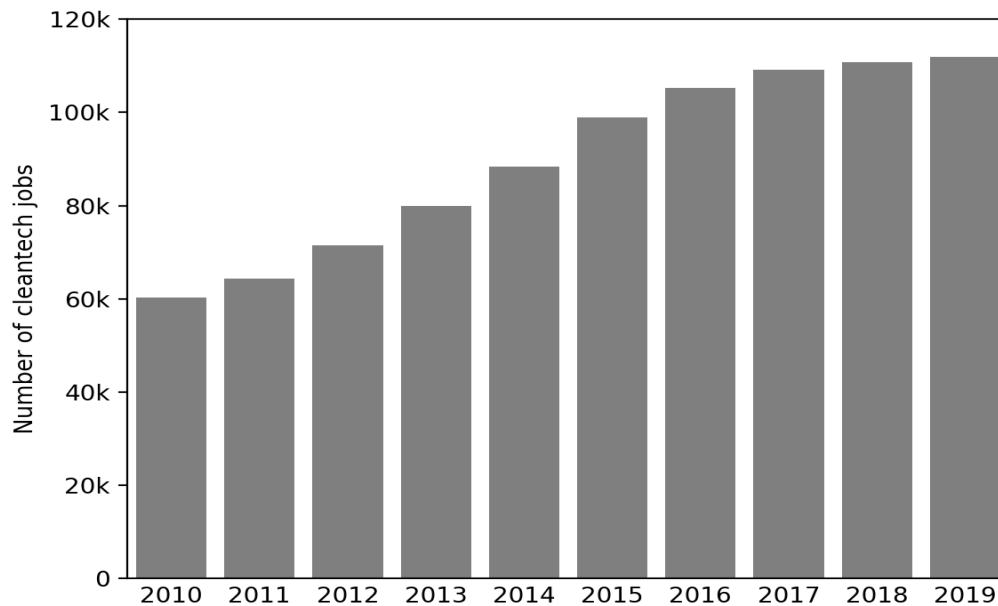


Figure 5: Number of cleantech jobs in Massachusetts [19]

Figure 6 shows how the number of cleantech companies has increased over the last five years [19].²

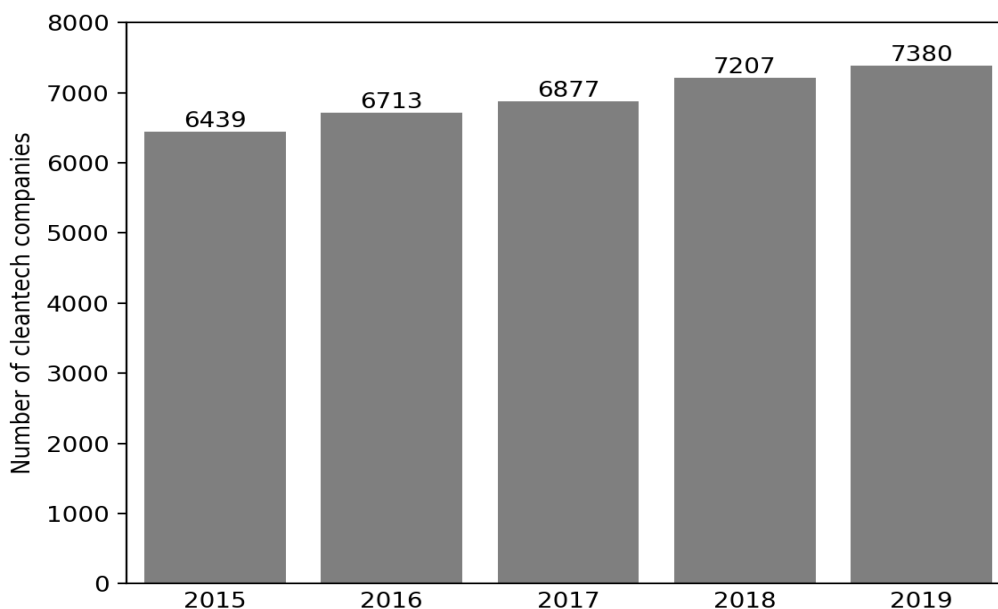


Figure 6: Number of cleantech companies in Massachusetts [19]

2. Only jobs in the following cleantech segments are considered: (1) renewable energy production, storage and distribution, (2) energy efficiency, (3) sustainable transportation (i.e., jobs in sustainable food, resource efficiency and sustainable finance are not included)



Startups



The following overview, compiled in April 2020, shows the development of the number of cleantech startups in the state of Massachusetts over the last 20 years. Furthermore, the development of the Massachusetts cleantech sector is directly compared with the Swiss counterpart.³ Although Switzerland's gross domestic product (GDP) is around 24 % higher (in 2018 according to [20] and [21]) and its population around 23 % larger than Massachusetts (according to [22] and [23]), the two regions are economically in the same order of magnitude and therefore quite comparable.

Figure 7 shows the number of annually founded cleantech startups in Massachusetts and Switzerland over the last 20 years.

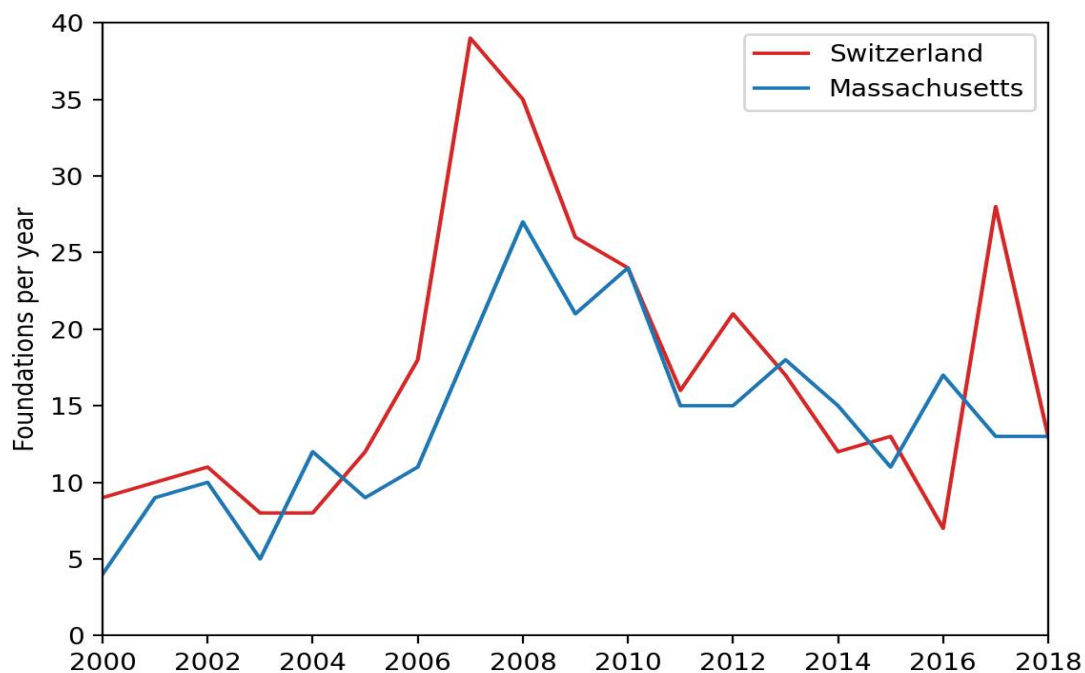


Figure 7: Number of cleantech startups founded per year

Both regions show a very similar trend with an average of 14 new cleantech startups per year in Massachusetts and 17 new startups in Switzerland. Both regions had their peaks of new startups in 2007/08. This cleantech boom, followed by its collapse, is sometimes called the “cleantech bubble” or the “green bubble”. According to literature, several factors were responsible for the bursting of the bubble [24]: newly cheap natural gas (through technical advances in natural gas extraction from shale, e.g., hydraulic fracturing), the 2008 financial crisis, fluctuating silicon prices (which most traditional solar cells are made of) and China's emerging solar industry. Since this “cleantech bubble”, there has been a slowdown in the number of new cleantech startups, whereby the numbers in Massachusetts have stabilized in recent years.

3. All data was retrieved from Crunchbase on April 21, 2020, with the following filters: location = Massachusetts/Switzerland, industry group = sustainability

Funding

Figure 8 shows the number of cleantech funding rounds (per year) over the last 20 years whereas Figure 9 shows the annual amount of funding over the same time period.

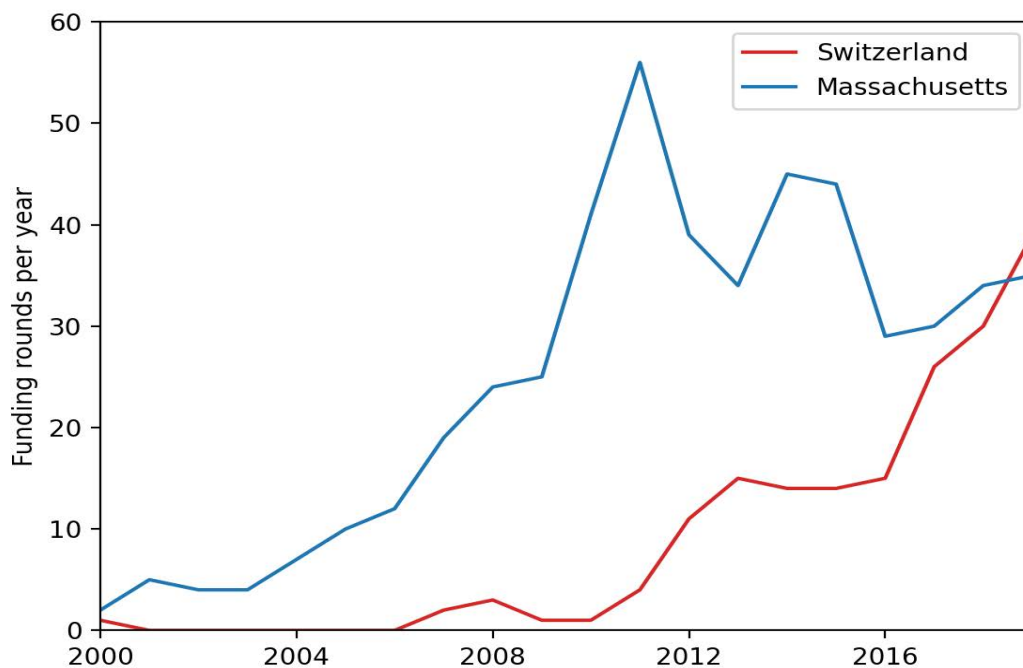


Figure 8: Number of cleantech funding rounds per year

Switzerland had long been far behind Massachusetts regarding the number of funding rounds for cleantech startups (Figure 8). Only around ten years ago the number of funding rounds in the Swiss cleantech sector was close to zero. Afterwards, however, the numbers increased strongly in Switzerland and today both regions, Massachusetts and Switzerland, have very similar cleantech funding activities (in terms of number of funding rounds). In contrast, the picture is very different when looking at the actual amount of funding in the two regions (Figure 9): Massachusetts has been well ahead of Switzerland with much more venture capital (VC) going to cleantech startups.

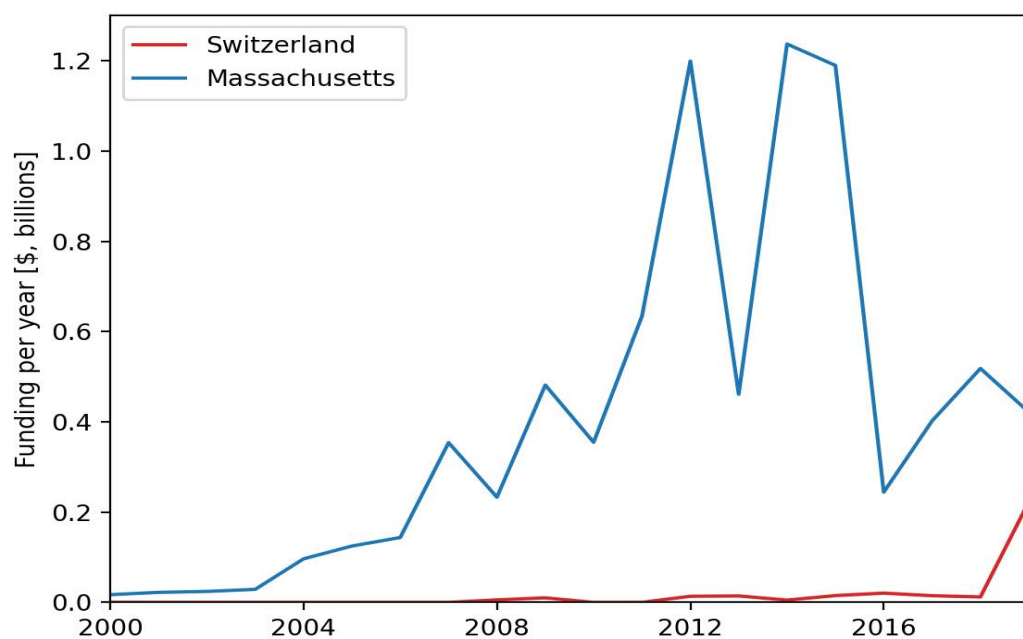


Figure 9: Annual amount of funding for cleantech startups (everything converted in current US dollars)



Figure 10 illustrates the total difference in funding for cleantech startups between the two regions (cumulated over the last 20 years) and highlights the global importance of the Boston area in terms of venture capital.

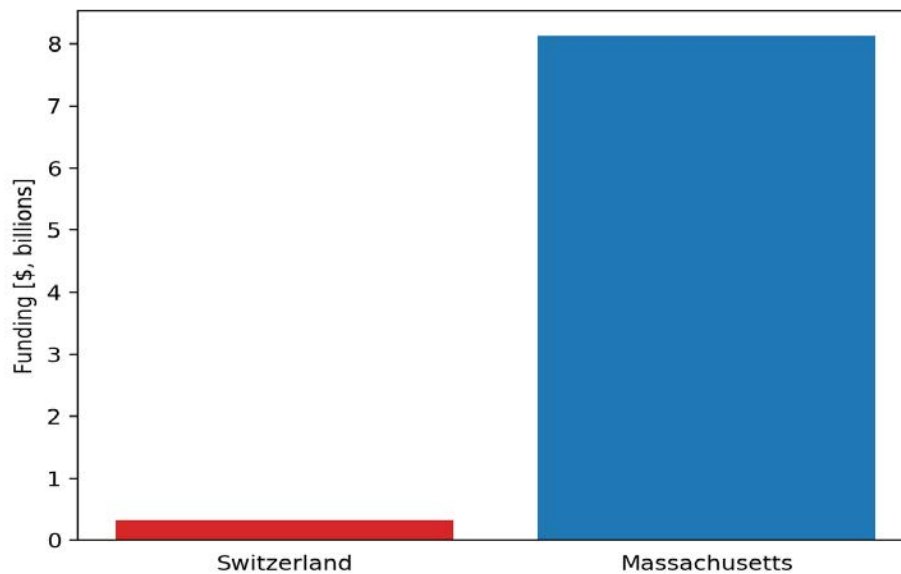


Figure 10: Total amount of funding for cleantech startups over 2000-2019

Key Drivers and Challenges

swissnex conducted a survey of 16 cleantech experts in order to identify the main key drivers and challenges in the Boston cleantech sector.⁴ Among the experts were entrepreneurs, investors, researchers, consultants, startup coaches/mentors and authorities that are active in the Boston cleantech sector. Figure 11 shows the key drivers for the cleantech sector, i.e., the growth driving forces.

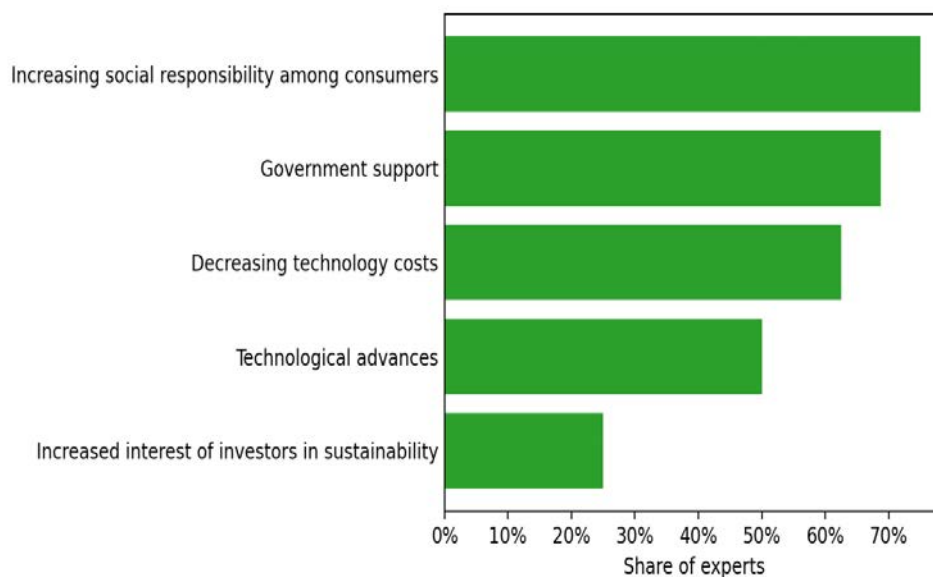


Figure 11: Key drivers for cleantech

4. The survey was created with Google Forms and took place between mid-May and mid-June 2020, and it comprised eight multiple choice questions. Using experts' knowledge and experience, the results of this survey are used to gain knowledge about key drivers and challenges in the cleantech sector (Chapter 5.4), gain insights into future developments (Chapter 5.5) and to obtain an assessment of the impact of the coronavirus pandemic on the cleantech sector (Chapter 5.6). The survey results represent judgements of experts, i.e., personal opinions.

Most experts agree that an increase in consumer demand for sustainable and socially responsible products is the biggest key driver for the cleantech sector, followed by government support (like subsidies) and decreasing technology costs. In contrast, insufficient government policies and regulations and a lack of funding are considered the greatest barriers for cleantech (see Figure 12). This shows that the role of the government is regarded as crucial: The right policies and regulations can act as a key driver – but become a major barrier for cleantech growth when they are lacking. As a result, the government can be both a growth stimulant and a growth depressant for the cleantech sector.

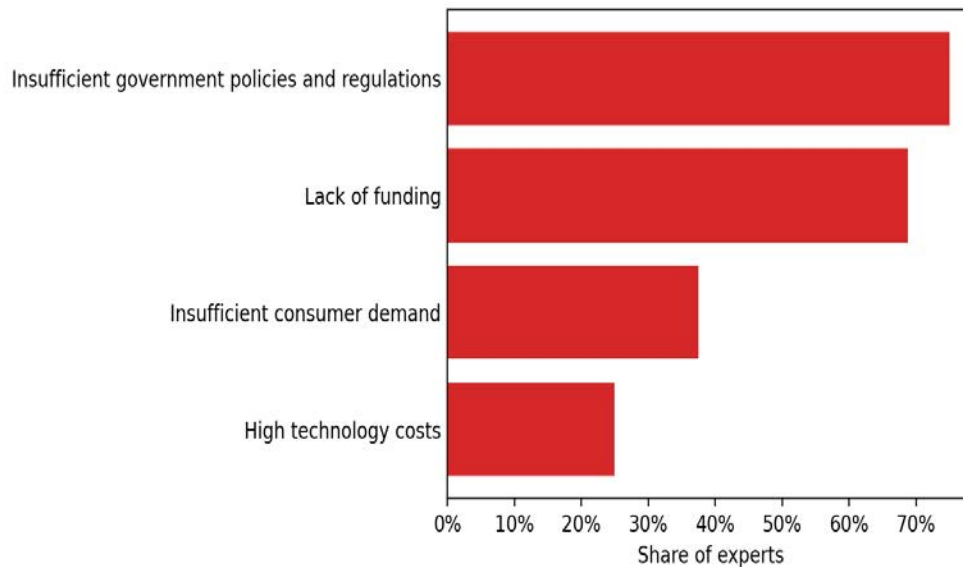


Figure 12: Main challenges for cleantech

Outlook

In the short term (i.e., within the next five years), the interviewed experts expect the strongest growth in the “renewable energy production, storage and distribution” cleantech segment. In the long term (i.e., in more than ten years), on the other hand, strongest growth is expected in the “resource efficiency” segment. The experts’ expectations on the growth potential of various cleantech segments are summarized in the following table:⁵

	Short term (<5 years)	Long term (10+ years)
Renewable energy production, storage and distribution	⬆	⬆
Energy efficiency (e.g. in buildings)	⬆	⬆
Sustainable food and agriculture	⬆	⬆
Sustainable transportation (e.g. electric vehicles)	⬆	⬆
Resource efficiency (e.g. circular economy)	➡	⬆
Sustainable finance (e.g. impact investing)	⬆	⬆

5. An arrow pointing vertically upwards means that all experts, i.e., 100 %, expect strong growth in the corresponding segment. An arrow pointing horizontally to the right means that no expert, i.e., 0 %, expect strong growth in the corresponding segment. Red means that 0-25 %, yellow 26-50 %, light green 51-75 % and dark green means that 76-100 % of the experts expect strong growth.



In terms of specific technologies, products or services in the cleantech sector, the experts see solar power, wind power and building electrification (heat pumps, etc.) as most promising in the short term. Carbon capture and storage (CCS), on the other hand, is expected to be most promising in the long term. In addition, some clean technologies are currently still considered insignificant, but in the longer term they are believed to have great impact. These include nuclear power, fusion power, synthetic fuels (power-to-gas), afforestation, CSS, insects as food and algae agriculture and food. The following table shows the experts' expectations on the growth potential of specific cleantech technologies:⁶

	Short term (<5 years)	Long term (10+ years)
Solar power	⬆	⬆
Wind power	⬆	⬆
Geothermal power	➡	⬆
Nuclear power	➡	⬆
Fusion power	➡	⬆
Natural gas	➡	➡
Electrification of transport	⬆	⬆
Building electrification (heat pumps, etc.)	⬆	⬆
Autonomous vehicles and ridesharing	➡	⬆
Lab-grown meat	➡	⬆
Smart appliances (Internet of Things)	⬆	➡
Biofuels	➡	➡
Synthetic fuels (power-to-gas)	➡	⬆
Afforestation	➡	⬆
Carbon capture and storage (CCS)	➡	⬆
Insects as food	➡	⬆
Smart farming ⁵	⬆	➡
Algae agriculture and food	➡	⬆
Bioplastic	➡	⬆
Sustainable investing/finance	⬆	➡
Recycling consumer waste	➡	➡

6. The same methodology as in the previous table applies.

Cleantech in a Post-Pandemic World

Figure 13 shows the survey results regarding the expected impact of the COVID-19 crisis on the cleantech sector (including the 95 % confidence interval). The cleantech experts expect the COVID-19 crisis to have a rather negative impact on the cleantech sector in the short term, i.e., in the coming months. In the long term, however, the experts are more optimistic: They expect a slightly positive impact on the cleantech sector in the next years and a clear positive impact over the next decades.

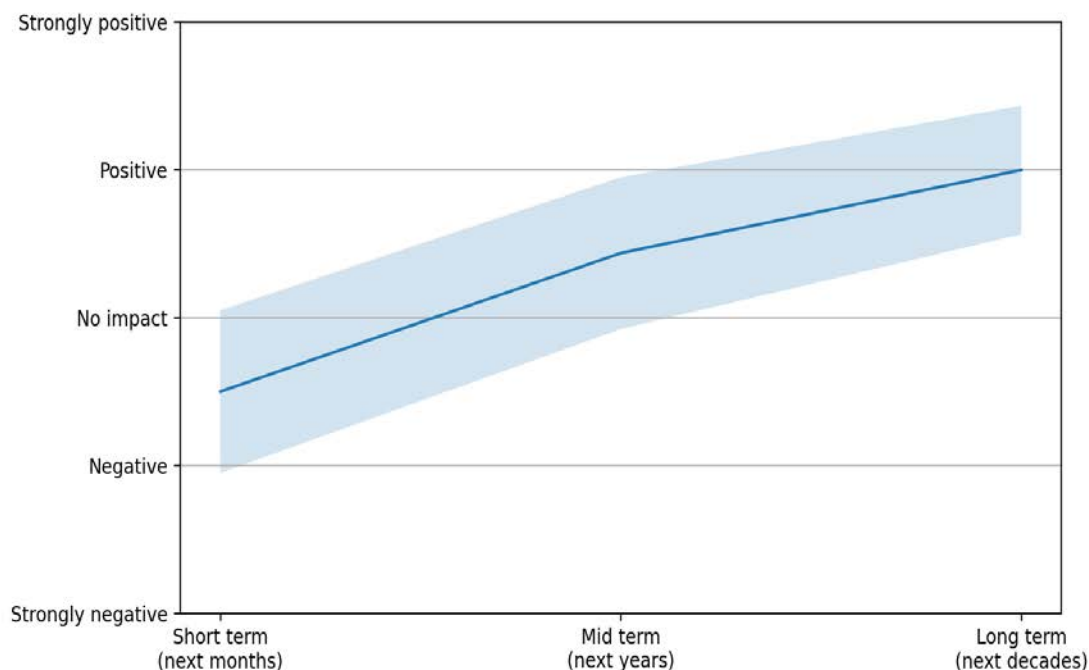


Figure 13: Impact of COVID-19 crisis on cleantech sector

This rather positive view is also supported by other experts and analysts: A recent McKinsey & Company report predicts that governments will likely devote a significant part of the resources deployed for economic recovery to climate change resiliency and mitigation, and that lower interest rates may accelerate the deployment of new sustainable infrastructure in the private sector [25]. The COVID-19 crisis could additionally raise awareness of the impact of a climate crisis, so that the public and private sector will try to build back better.

This hypothesis is supported by a survey about climate change concerns that was conducted in April 2020 by scholars at Yale University and George Mason University [26]. The authors had been prepared to find dramatically reduced levels of concern about climate change due to the ongoing COVID-19 pandemic. However, they were surprised that several indicators of public engagement actually reached record levels. For example, a record 73 percent of Americans believe that global warming is happening.

Additionally, a long list of cleantech investors and incubators confirmed in an open letter to their current and future startup founders that they remain committed to support their current investments and to continuing to invest actively despite the COVID-19 crisis [27].

Even though these are definitely positive outlooks, a large majority of the surveyed cleantech experts is convinced that the impact of the COVID-19 crisis on the cleantech sector very much depends on the government response, i.e., the various stimulus packages addressing the COVID-19 crisis. This view is also supported by various leading researchers in the fields of renewable energy and energy policy [28] [29].

They agree that COVID-19 stimulus packages represent a critical juncture for climate policy and therefore a unique opportunity to address the climate crisis. Furthermore, they suggest that no bailout should benefit industries and business models not compatible with the climate targets. For example, polluting industries should only be supported by the state if they agree to more stringent decarbonization efforts. Governments therefore bear a great responsibility: The impact of the COVID-19 crisis on the cleantech sector heavily depends on the government stimulus packages.





The Cleantech Startup Ecosystem in Boston

Numerous players are involved in the Boston cleantech ecosystem. In the following sections we list some of the services and assets available to cleantech startups in the region.⁷ While this list is by no means exhaustive, it helps to provide a general overview of the cleantech startup ecosystem in Boston.

Incubators

The Boston area is home to some very large and state-of-the-art cleantech incubators. Startup incubators are collaborative programs designed to support new startups by providing workspace, funding, mentoring, training and other resources: They “incubate” early-stage startups with innovative ideas.



Greentown Labs

Located in Somerville, Massachusetts, and founded in 2011, the Greentown Labs Global Center for Cleantech Innovation is the largest cleantech incubator in North America. The almost 10,000 m² campus comprises prototyping and wet lab space, shared office space, a machine shop, electronic labs and event space. Greentown Labs is home to more than 90 startups and has supported more than 210 since its inception.

Website: <https://www.greentownlabs.com/>



North Shore InnoVentures (NSIV)

NSIV is a non-profit incubator located in Beverly, Massachusetts, that supports startups in the cleantech and biotech sectors. NSIV provides promising startups with office space, shared laboratories and equipment, sponsored professional services, successful entrepreneur mentors and investor advisers.

Website: <https://nsiv.org/>



The Engine

The Engine, built by MIT, is an incubator and venture firm located in Cambridge, Massachusetts, that invests in early-stage companies solving the world's biggest problems through the convergence of breakthrough science, engineering and leadership. Taking the long view, the Engine supports founders with long-term capital, labs, equipment, tools and a network.

Website: <https://www.engine.xyz/>

⁷. All information about an organization was retrieved either from the organization's website or its LinkedIn profile.

Accelerators

Accelerator programs have a set timeframe in which startups are working with mentors to build out their business and culminate in a public pitch event or demo day. Many startup accelerators also include seed investment and start with an application process. The following are some accelerators that are tailored to cleantech startups.



Cleantech Open Northeast

The Cleantech Open runs the world's largest cleantech startup accelerator program, with the mission to find, fund, and foster entrepreneurs with ideas to solve pressing environmental and energy challenges. Through their annual business competition and accelerator program, they connect cleantech startups with the people and resources that will accelerate their success and provide a national platform for public visibility. cleantech Open Northeast covers Massachusetts, Vermont, Maine, Connecticut, Rhode Island, New Hampshire, New York, Pennsylvania and New Jersey.

Website: <https://www.cleantechopen.org/en/page/northeast-en>



Greentown Labs Bold Ideas Challenge

The Greentown Labs Bold Ideas Challenge is a 6-month accelerator program housed at Greentown Labs, focused on founders with a potential innovation in the energy space. The startups get free space at Greentown Labs, funding, mentorship, access to various networks and will be eligible for potential partnership or investment from Schneider Electric by the end of the program.

Website: <https://www.se.com/ww/en/work/campaign/greentown-labs-bold-ideas-challenge/>



MassChallenge Boston

MassChallenge Boston is an early-stage startup accelerator program for startups in any industry sector. The selected startups receive mentorship, entrepreneurship and industry training, free co-working space and the opportunity to win non-dilutive cash prizes.

Website: <https://masschallenge.org/programs-boston>



Techstars

Techstars is an American seed accelerator with branches in New York City and Boston. Each year, they choose over 500 early-stage companies to join one of their 3-month, mentorship-driven accelerators. Techstars portfolio includes more than 2,100 startups. However, it is quite hard to get accepted.

Website: <https://www.techstars.com/>



TiE ScaleUp

TiE ScaleUp is a 6-month, sector-agnostic accelerator program from TiE Boston. They are looking for startups at an appropriate stage of growth and support them with sector-specific mentorship, CEO and industry partner roundtables, access to investors throughout the program, as well as a showcase at the end of the program.

Website: <https://www.tiescaleup.org/>



Funding Sources

There is a large and growing number of VC firms specializing in cleantech investments in the Boston area. For more and more VC firms a positive environmental impact is becoming an investment criterion in the composition of their portfolio. In addition to VC firms, the Boston area is also home to a large number of family offices investing in sustainable portfolios.



Anterra Capital

Anterra Capital is an independent growth capital fund with an office in Boston and invests in startups that are working to make the global food supply chain safer, more efficient and more sustainable. Their focus is on supporting the growth of companies who are commercializing novel technologies and services. Anterra Capital invests across the food supply chain from novel agro inputs and precision farming through to smarter logistics and consumer safety.

Website: <https://www.anterracapital.com/>



Breakthrough Energy Ventures

Breakthrough Energy Ventures is a fund that was created in 2016 by the Breakthrough Energy Coalition, a global group of high net-worth investors like Bill Gates, Jeff Bezos and Richard Branson. Breakthrough Energy Ventures invests in American companies that leverage innovative technologies to help address climate change. Their focus is on startups that address challenges in the areas of electricity, transportation, agriculture, manufacturing and buildings.

Website: <https://www.b-t.energy/ventures/>



Bolt

Bolt is a concept-stage/pre-seed venture capital firm with offices in San Francisco and Boston. They typically invest between \$200 k and \$1.5 m and focus on companies where physical products coupled with software enable long-lasting customer relationships and high-margin recurring revenue business models.

Website: <https://bolt.io/>



Building Ventures

Building Ventures is a venture capital firm located in Boston that provides venture capital funding and mentoring to early-stage startups in the built environment space.

Website: <https://www.buildingventures.com/>



Clean Energy Venture Group

Clean Energy Venture Group is an investment group with offices in Boston and New York which provides seed capital and management expertise to early stage cleantech companies. The group focuses on startups located in the Northeastern United States.

Website: <https://cevg.com/>



Clean Energy Ventures

Clean Energy Ventures is a venture capital firm with headquarters in Boston that invests in, supports and mentors early-stage cleantech startups. Clean Energy Ventures focuses on companies commercializing disruptive advanced clean energy technologies and business model innovations that are able to achieve significant scale by taking advantage of market-driven forces to address global climate change.

Website: <https://cleanenergyventures.com/>



Energy Impact Partners

Energy Impact Partners is an investment firm located in New York that focuses on the conversion of the energy industry towards a decarbonized, decentralized, digitized and electrified future. They have already invested in multiple cleantech startups.

Website: <https://www.energyimpactpartners.com/>



Green Bean Capital

Green Bean Capital is an investment firm located in Boston that focuses on renewable energies, real estate and food and beverages.

Website: <https://www.greenbeancapital.com/>



MassVentures

MassVentures is located in Boston and one of the oldest and longest running venture capital firms in the world. They provide equity financing to early-stage startups from various sectors.

Website: <https://www.mass-ventures.com/>



Material Impact

Material Impact is a venture capital fund located in Boston that invests in startups which transform materials technologies into products that make an impact on real-world problems. Material Impact invests, among others, in cleantech startups.

Website: <http://materialimpact.com/>



Prime Impact Fund

Prime Impact Fund invests in cleantech startups that combat climate change, have a high likelihood of achieving commercial success and would otherwise have a difficult time raising sufficient financial support. The Prime Impact Fund is an initiative of the Prime Coalition, a public charity that partners with philanthropists.

Website: <https://primecoalition.org/>



RockPort Capital

RockPort Capital is a multi-stage venture capital firm that invests in the areas of alternative and traditional energy, mobility and sustainability. RockPort has its headquarters in Boston and is globally recognized as being among the largest and most established energy-focused venture capital firms.

Website: <http://www.rockportcap.com/>



SustainVC

SustainVC is a venture capital firm with offices in Boston, Philadelphia and Durham that invests in early-stage startups creating meaningful social and/or environmental impact. SustainVC typically invests between \$250 k and \$1 m and is committed to actively engaging and supporting their portfolio companies.

Website: <https://sustainvc.com/>





Wave Equity Partners

WAVE, a Boston based private equity firm, provides expansion capital for market validated cleantech companies that operate in the field of energy, food, water and/or waste. Their investments typically lie between \$15 and \$20 m.

Website: <https://waveep.com/>



WindSail Capital Group

WindSail is a venture capital firm located in Boston that provides growth financing to companies advancing energy innovation and sustainability. WindSail's investments typically range from \$2 m to \$10 m and are in the form of a secured loan.

Website: <https://www.windsailcapital.com/>



10X Venture Partners

10X Venture Partners is a seed stage (and beyond) investment group located in Manchester, New Hampshire, that also commits operational experience to their portfolio companies. A typical investment ranges from \$50 k to \$500 k and they have experience in the cleantech sector.

Website: <https://www.10xvp.com/>

Communities and Networks

Besides all the cleantech incubators, accelerators and VC firms there are also many startup support services for community networking. Some of these organizations are not exclusively for cleantech startups but still offer a good opportunity to make contacts in the Boston startup ecosystem.



Boston New Technology

Boston New Technology is a networking group for entrepreneurs, investors, coders, designers, business-developers, marketers, technology enthusiasts and other professionals to connect at live events, share opportunities, collaborate, launch and learn about new product ventures, form partnerships and grow businesses.

Website: <https://bostonnewtechnology.com/>



Branchfood

Branchfood is the largest community of food innovators in New England and located in Boston. It supports food entrepreneurs with co-working space, events and capital.

Website: <https://www.branchfood.com/>



Cambridge Innovation Center (CIC)

CIC supports startups by providing high-quality infrastructure and programming. This includes flexible and custom office space, shared wet lab facilities, civic innovation spaces and targeted initiatives to support out-of-the-box thinking. CIC operates shared office and lab space in Cambridge and Boston. Each CIC site is accompanied by close partnerships with universities, civic organizations and special industry hubs.

Website: <https://cic.com/>



Massachusetts Clean Energy Center (MassCEC)

MassCEC is a state economic development agency dedicated to accelerating the growth of the clean energy sector across the Commonwealth of Massachusetts in order to create new jobs, lower the state's environmental impact and secure long-term economic growth. For this, MassCEC utilizes incentives for clean energy technology installations, financing for startups and technology development, as well as investments in training programs to build a clean energy workforce. Moreover, MassCEC fosters collaboration among the industry, research institutions, financial sector and policy makers, and provides assistance to enable startups to access capital and other vital growth resources.

Website: <https://www.masscec.com/>

**Mass
Innovation
Nights**



Mass Innovation Nights

Innovation Nights is a free monthly product launch party and networking event powered by social media. Every month, Mass Innovation Nights brings together ten companies at various venues throughout metro Boston that launch their new products. Researchers, social media experts and attendees are able to spread the word via social media, creating high visibility for participating startups. Over the past 11 years, Mass Innovation Nights has helped to launch more than 1,500 new products that have received more than \$4 billion in collective funding.

Website: <https://mass.innovationnights.com/>



Mass Technology Leadership Council (MassTLC)

MassTLC is the largest technology association in the region and its mission is to accelerate growth and innovation in the Massachusetts technology industry. For more than 30 years, MassTLC has been connecting tech leaders, investors, academics and policy makers by fostering collaboration, knowledge sharing and research, and grow tech startups through peer groups, recruitment initiatives and networking.

Website: <https://www.masstlc.org/>



Northeast Clean Energy Council (NECEC)

NECEC is a non-profit organization in Boston that helps cleantech companies to start, scale and succeed with its business, innovation and policy leadership. It brings together business leaders and key stakeholders to engage in policy discussions and business initiatives. Therefore, NECEC serves as the lead voice for hundreds of cleantech companies across the Northeast, influencing the energy policy agenda and growing the clean energy economy.

Website: <https://www.necec.org/>



SeaAhead

SeaAhead is a benefit corporation located in Boston with the mission of supporting new venture development at the intersection of innovation, sustainability and the oceans. Their ecosystem includes technologists, scientists, startups, corporations and governments. SeaAhead supports startups that create impact in areas including greener shipping and ports, aquaculture and fishery processes, offshore alternative energy and smart cities.

Website: <https://sea-ahead.com/>





Venture Café Cambridge

Venture Café Cambridge by the Venture Café Foundation is located inside the Cambridge Innovation Center and supports the startup community with spaces, programs and networking events. Their weekly networking event on Thursday is well-known in the local startup community and always well attended. The events are free and open to anyone.

Website: <https://venturecafecambridge.org/>



VentureWell

VentureWell is a non-profit organization located in Hadley, Massachusetts, that supports early-stage startups through various mentoring and educational programs, grants and networking events. Thereby, VentureWell's focus is on startups in fields such as biomedicine and healthcare, sustainable energy and materials and solutions for low-resource settings.

Website: <https://venturewell.org/>

Academic Institutions

The Boston area is home to 51 colleges and universities, which are shown in Figure 14.

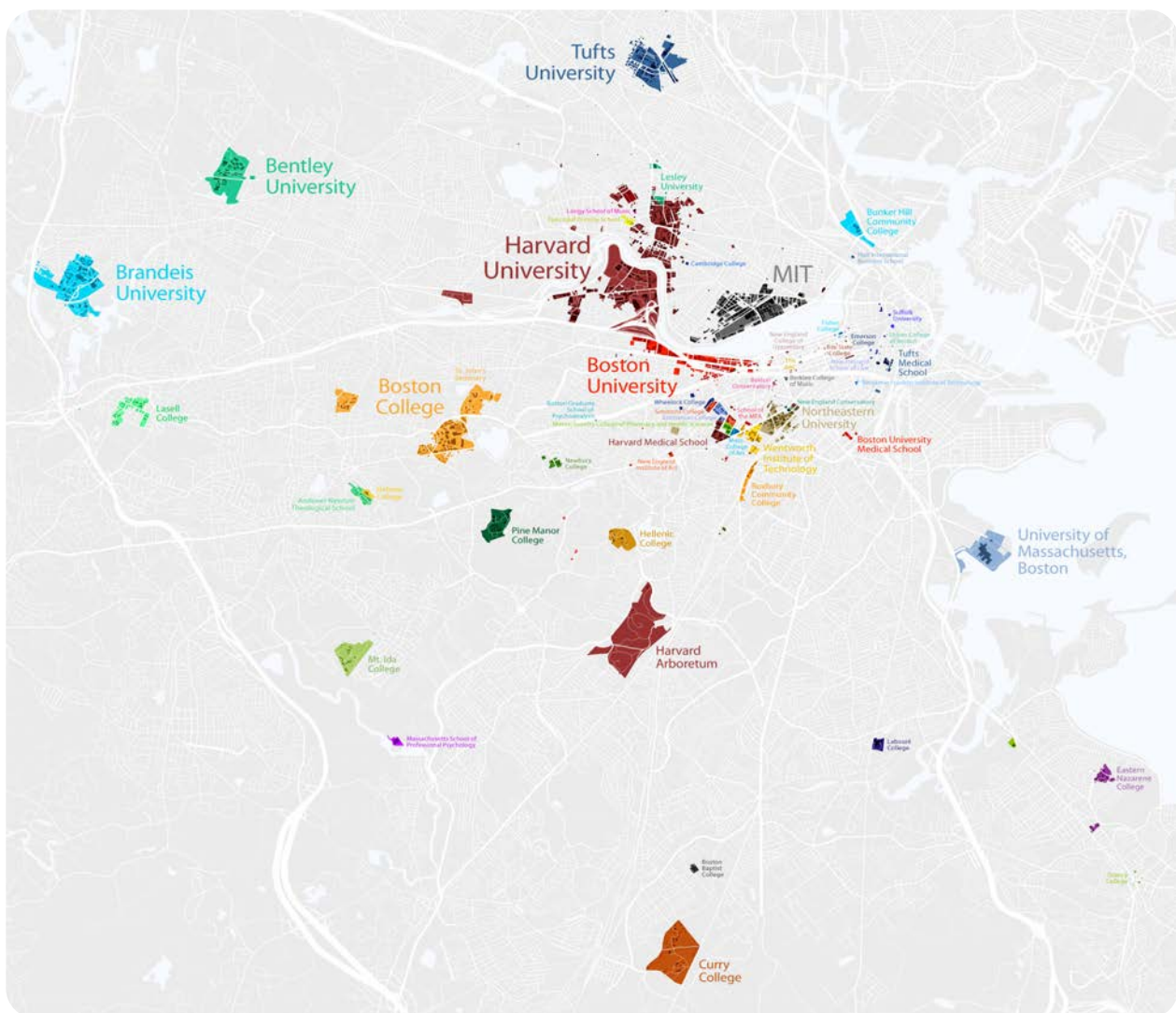


Figure 14: Colleges and universities within Massachusetts Route 128 [30].

Some of the best known and renowned academic institutions are briefly described below:



Boston College

Boston College is a private Jesuit research university Chestnut Hill, Massachusetts. Building upon its traditions, Boston College is a leader in liberal arts with a Jesuit-Catholic mission of faith and service. All schools and colleges can be found on the following website: <https://www.bc.edu/content/bc-web/academics/schools-fields-of-study.html>



**BOSTON
UNIVERSITY**

Boston University

Boston University is a private research university in Boston, Massachusetts, and particularly active in the following fields of research: Data Science, Engineering Biology, Global Health, Infectious Diseases, Neuroscience, Photonics and Urban Health. The following website provides an overview of all Boston University centers and institutes: <https://www.bu.edu/research/our-research/institutes-centers/>



**HARVARD
UNIVERSITY**

Harvard University

Harvard University is a private Ivy League research university in Cambridge, Massachusetts. Founded in 1636, Harvard is the oldest institution of higher learning in the United States and one of the most prestigious universities in the world. It is particularly known for its education and research activities in the fields of arts, sciences, engineering and medicine. The following website provides an overview of the different schools: <https://www.harvard.edu/schools>



**Massachusetts
Institute of
Technology**

Massachusetts Institute of Technology (MIT)

The Massachusetts Institute of Technology (MIT) is a private research university located in Cambridge, Massachusetts, which is widely known for its innovation and academic strength. With its strengths in applied science, engineering, mathematics and technology, MIT is one of the most prestigious institutions of higher learning in the world. The following website provides an overview of all MIT centers, labs and programs: <http://www.mit.edu/research/centers-labs-programs/>



**Northeastern
University**

Northeastern University

Northeastern University is a private research university with a distinctive, experience-driven approach to education. Northeastern features a cooperative education program, that integrates classroom study with professional work experience in more than 100 countries. The university's nine colleges and schools can be found on the following website: <https://www.northeastern.edu/academics/colleges/>



**Tufts
UNIVERSITY**

Tufts University

Tufts University is a private research university in Medford and Somerville, Massachusetts. The prestigious university is known for such fields as international relations, liberal arts, economics and computer science. The following website provides an overview of the different schools: <https://www.tufts.edu/schools>





Academic Initiatives

MIT has launched various initiatives to support cleantech startups and research projects. Below is a brief overview of the most notable initiatives.



Clean Energy Prize @ MIT

The Clean Energy Prize at MIT (CEP@MIT) is the longest running and largest cleantech startup competition for university students. Each year the teams will compete for more than \$100 k in prize money. Startups are only eligible if at least 50 % of formal team members are enrolled as university students.

Website: <https://cep.mit.edu/>



MIT Energy Club

The MIT Energy Club connects students, alumni and community members who are passionate about energy. The club holds weekly events, including document-based energy discussion groups and the MIT Energy Lecture Series, alongside signature events such as the annual MIT Energy Night and the MIT Energy Conference.

Website: <https://www.mitenergyclub.org/>



MIT Energy Initiative

The MIT Energy Initiative is MIT's hub for energy research, education, and outreach and connects faculty, students and staff to develop the knowledge, technologies and solutions for clean, affordable, and plentiful sources of energy. The goal of the MIT Energy Initiative is to develop low-carbon solutions that will efficiently, affordably and sustainably meet global energy needs while minimizing environmental impacts, dramatically reducing greenhouse gas emissions and mitigating climate change. Furthermore, the MIT Energy Initiative hosts a lot of events, educational programs and other activities.

Website: <http://energy.mit.edu/>



MIT Environmental Solutions Initiative

MIT launched the Environmental Solutions Initiative in 2014, which is a campus-wide effort to coordinate and develop interdisciplinary solutions to urgent challenges in environment and sustainability. The initiative pursues multidisciplinary research, education, events and partnerships.

Website: <https://environmentalsolutions.mit.edu/>





Regulatory Environment

In 2019 and for the ninth year in a row, Massachusetts was named the most energy-efficient state in the US (see Figure 15) [31]. This rating includes energy efficiency policies and programs and reflects the government's effort to support clean energy and reduce its carbon footprint through tax incentives and grant programs. In particular, the introduction of the Green Communities Act of 2008 was a major milestone and significantly reformed the state's energy policy. In 2019, regulators approved a new efficiency-plan which includes a wide range of programs to align Massachusetts' saving efforts with the statewide greenhouse gas reduction goals. Massachusetts aims to reduce its greenhouse gas emissions by 80 % by 2050. The 2019 State Energy Efficiency Scorecard [31] gives a very detailed overview of energy efficiency policies in Massachusetts.

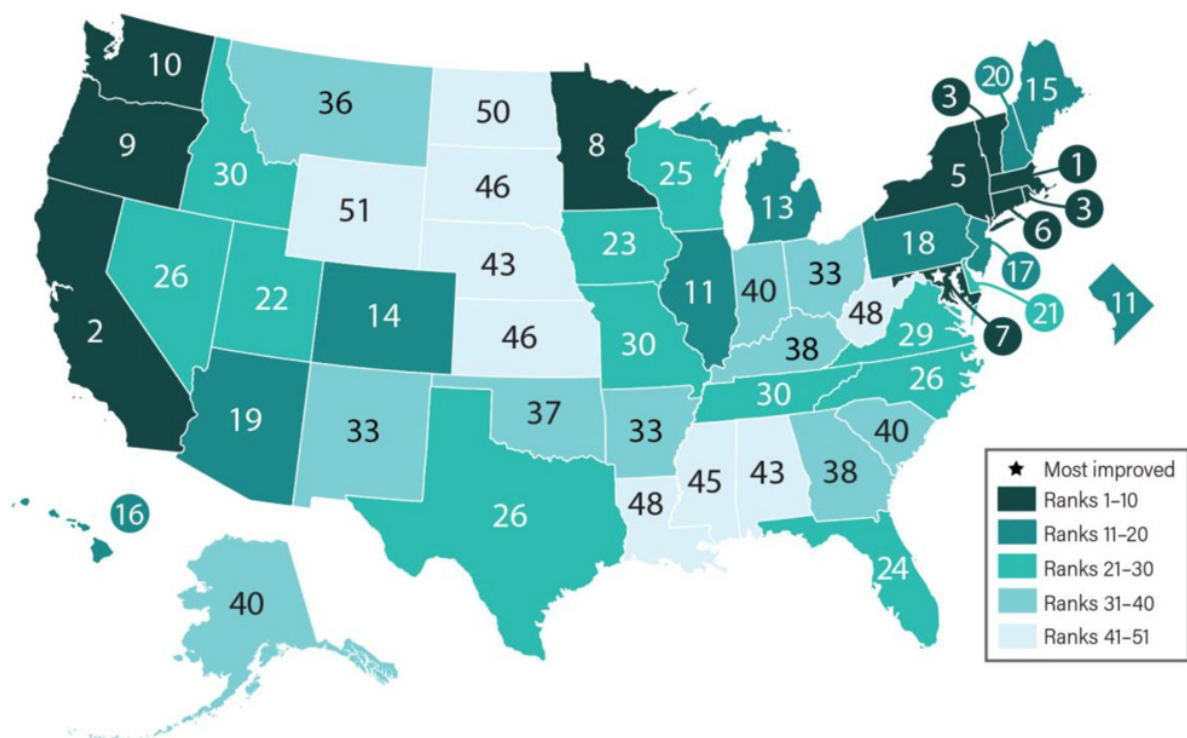


Figure 15: States' ranking according to their energy efficiency policy and program efforts [31]



Notable cleantech startups in Boston

Subsequently, an overview of ten notable cleantech startups in Massachusetts is given.⁸ Four of the listed startups are also represented in the top 100 cleantech startups worldwide in 2020 [12].



Sense

Sense specializes in developing and distributing tracking devices and home automation solutions for its customers. Sense uses machine learning technology to provide real-time insights on device behavior, even for those devices that are not smart. Customers can use Sense for a variety of purposes, such as monitoring their home appliances, determining whether they left appliances running and identifying major energy drains in their home so they can substantially reduce their energy costs.

- Year of foundation: 2013
- Total funding amount: \$47,999,999
- Website: <https://sense.com/>



Indigo

Indigo is building a system responsive to demands for high quality and sustainably produced food and fiber. Indigo develops microbial and digital technologies that improve grower profitability, environmental sustainability and consumer health. These technologies underpin its pioneering business model, which spans agriculture's full value chain.

- Year of foundation: 2014
- Total funding amount: \$809,000,000
- Website: <https://www.indigoag.com/>



VIA

VIA provides a big data analytics software that reduces the cost and improves the quality of service of electricity transmission and distribution using AI and blockchain technologies. Their product securely connects power company data, distributed across many locations, to potential AI solutions.

- Year of foundation: 2016
- Total funding amount: \$9,000,000
- Website: <https://www.solvewithvia.com/>



SparkCharge

SparkCharge develops and manufactures portable, ultrafast and modular charging stations for electric cars.

- Year of foundation: 2014
- Total funding amount: \$4,300,000
- Website: <https://sparkcharge.io/>



Commonwealth Fusion Systems

Commonwealth Fusion Systems is combining proven physics backed by decades of government-funded fusion research with a revolutionary superconducting magnet technology to accelerate the path to commercial fusion energy.

- Year of foundation: 2017
- Total funding amount: \$115,000,000
- Website: <https://cfs.energy/>

8. Most prominent according to Crunchbase rank; all data was retrieved either from the company's website or from Crunchbase on April 21, 2020, with the following filters: location = Massachusetts/Switzerland, industry group = sustainability



Bevi

Bevi offers smart and eco-friendly water dispensers that customize flavored and sparkling beverages on demand.

- Year of foundation: 2013
- Total funding amount: \$60,100,000
- Website: <https://www.bevi.co/>



Form Energy

Form Energy has identified and is developing a novel class of long duration energy storage systems. The new battery technology is low-cost, safe and scalable.

- Year of foundation: 2017
- Total funding amount: \$49,000,000
- Website: <https://formenergy.com/>



Spoiler Alert

Spoiler Alert provides food manufacturing and grocery distribution businesses with a holistic software platform to reduce the financial impact of distressed and surplus food inventory.

- Year of foundation: 2015
- Total funding amount: \$2,650,000
- Website: <https://www.spoileralert.com/>



WiTricity

WiTricity provides technology to enable wireless charging for electric vehicles using magnetic resonance.

- Year of foundation: 2007
- Total funding amount: \$36,000,000
- Website: <https://witricity.com/>



GreenLight Biosciences

GreenLight Biosciences focuses on sustainable production of chemicals and fuels using its patented cell-free bioprocessing technology platform.

- Year of foundation: 2008
- Total funding amount: \$96,000,000
- Website: <https://www.greenlightbiosciences.com/>



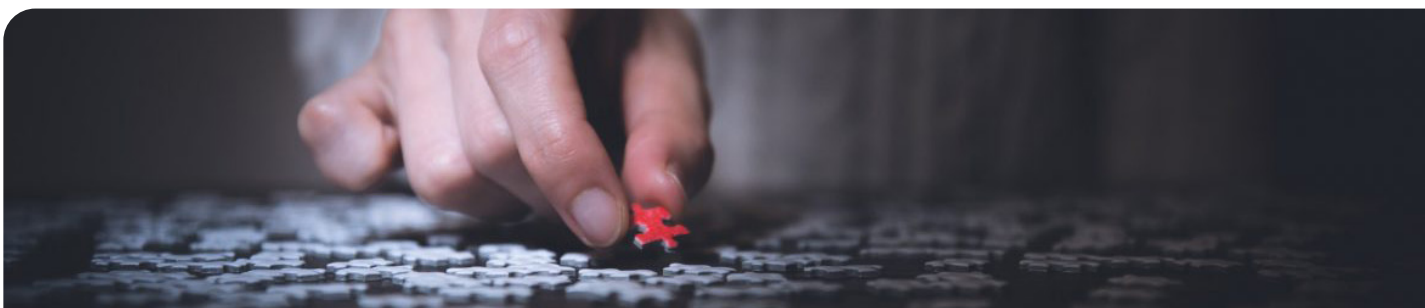
This report was written and researched by Diego Sigrist as part of his internship at swissnex Boston. He is a ETH Zurich alumnus and is now in the process of developing a cleantech startup based in Zurich.



References

1. International Panel on Climate Change, „Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change,“ 2018.
2. A. H. R. S. T. S. S. A. Wijnand de Wit, „Solving Plastic Pollution through Accountability,“ World Wildlife Fund, 2019.
3. J. S. E. B. Sandra Días, „Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science - Policy Platform on Biodiversity and Ecosystem Services,“ IPBES, 2019.
4. Greenpeace, „Overfishing & Destructive Fishing,“ [Online]. Available: <https://www.greenpeace.org/usa/oceans/issues/overfishing-destructive-fishing/>. [Zugriff am May 2020].
5. Food and Agriculture Organization of the United Nations, „State of the World's Forests 2020,“ [Online]. Available: <http://www.fao.org/state-of-forests/en/>. [Zugriff am May 2020].
6. World Health Organization, „Air pollution,“ [Online]. Available: https://www.who.int/health-topics/air-pollution#tab=tab_1. [Zugriff am June 2020].
7. United Nations, „Synthesis Report 2018 on Water and Sanitation,“ 2018.
8. World Wildlife Fund, „Water Scarcity | Threats | WWF,“ [Online]. Available: <https://www.worldwildlife.org/threats/water-scarcity>. [Zugriff am June 2020].
9. United Nations, „World Water Development Report 2009,“ 2009.
10. L. S. A. L. Zoltán J. Ács, „The Global Entrepreneurship Index 2018,“ The Global Entrepreneurship and Development Institute, 2018.
11. C. Swarder, „The Global Cleantech Innovation Index 2017,“ Cleantech Group, WWF, 2017.
12. Cleantech Group, „Global Cleantech 100,“ 2020.
13. MassTech Collaborative, „The Annual Index of the Massachusetts Innovation Economy,“ 2019.
14. K. W. E. K. W. M. M. O. J. T. Z. Z. Y. Surana, „Regional clean energy innovation: Regional factors for accelerating the development and deployment of climate mitigation technologies“, „Energy Futures Initiative with University of Maryland Global Sustainability Initiative, 2020.
15. Hickey & Associates, „Global Innovation Hubs,“ 2019.
16. 2thinknow, „Innovation Cities Index 2019,“ 2019. [Online]. Available: <https://www.innovation-cities.com/index-2019-global-city-rankings/18842/>. [Zugriff am 15 April 2020].
17. K. M. K. Richard Florida, „Rise of the Global Startup City,“ Martin Prosperity Institute, 2016.
18. American Council for an Energy-Efficient Economy, „The 2019 City Clean Energy Scorecard,“ 2019.
19. Massachusetts Clean Energy Center, „2019 Massachusetts Clean Energy Industry Report,“ Boston, 2019.
20. U.S. Bureau of Economic Analysis, „Regional Data: GDP and Personal Income,“ [Online]. Available: <https://apps.bea.gov/itable/itable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1>. [Zugriff am April 2020].

21. The World Bank, „Switzerland | Data,“ [Online]. Available: <https://data.worldbank.org/country/switzerland>. [Zugriff am April 2020].
22. Data USA, „Massachusetts | Data USA,“ [Online]. Available: <https://datausa.io/profile/geo/massachusetts>. [Zugriff am April 2020].
23. Swiss Federal Statistical Office, „Population,“ [Online]. Available: <https://www.bfs.admin.ch/bfs/en/home/statistics/population.html>. [Zugriff am April 2020].
24. J. Eilperin, „Why the Clean Tech Boom Went Bust,“ WIRED, 20 January 2012. [Online]. Available: https://www.wired.com/2012/01/ff_solyndra/. [Zugriff am May 2020].
25. McKinsey & Company, „Addressing climate change post-coronavirus | McKinsey,“ 7 April 2020. [Online]. Available: https://www.mckinsey.com/business-functions/sustainability/our-insights/addressing-climate-change-in-a-post-pandemic-world?utm_source=Clean+Energy+Ventures+Community&utm_campaign=a5860be469-Newsletter+--+Q2-2020&utm_medium=email&utm_term=0_6868e3f18f-a5860. [Zugriff am June 2020].
26. A. M. E. R. S. K. J. B. P. B. M. G. M. G. A. & W. X. Leiserowitz, „Climate Change in the American Mind: April 2020,“ Yale University and George Mason University, New Haven, 2020.
27. Clean Energy Ventures, „An Open Letter from Climatetech Investors on Coronavirus,“ April 2020. [Online]. Available: https://cleanenergyventures.com/investor-open-letter-coronavirus/?utm_source=Clean+Energy+Ventures+Community&utm_campaign=a5860be469-Newsletter+--+Q2-2020&utm_medium=email&utm_term=0_6868e3f18f-a5860be469-226550273. [Zugriff am June 2020].
28. N. Schmid, „COVID-19 stimulus packages represent a critical juncture for climate policy,“ Energy Blog @ ETH Zurich, 2 April 2020. [Online]. Available: <https://blogs.ethz.ch/energy/covid-19/>. [Zugriff am June 2020].
29. M. Liebreich, „Liebreich: Covid-19 – The Low-Carbon Crisis,“ BloombergNEF, 26 March 2020. [Online]. Available: <https://about.bnef.com/blog/covid-19-the-low-carbon-crisis/>. [Zugriff am June 2020].
30. B. Rankin, Artist, College Town. [Art]. Radical Cartography, 2009.
31. American Council for an Energy-Efficient Economy, „The 2019 State Energy Efficiency Scorecard,“ Washington, DC, 2019.
32. Energy Future Initiatives (EFI), National Association of State Energy Officials (NASEO), BW Research Partnership (BWR), „US Energy + Employment Report 2020,“ 2020.
33. Cleantech Open Northeast, „2019 Cleantech Open Northeast Impact Report,“ 2019.
34. Advanced Energy Economy, „Advanced Energy Now 2019 Market Report,“ 2019.
35. Boston University, Green Ribbon Commission, „Carbon Free Boston,“ Boston, 2019.



For more information on how swissnex Boston can help Swiss startups navigate the Boston and MA cleantech ecosystem, please reach out to Alicia Evangelista, our Head of Innovation+ at alicia@swissnexboston.org or head to our website at www.swissnexboston.org.

