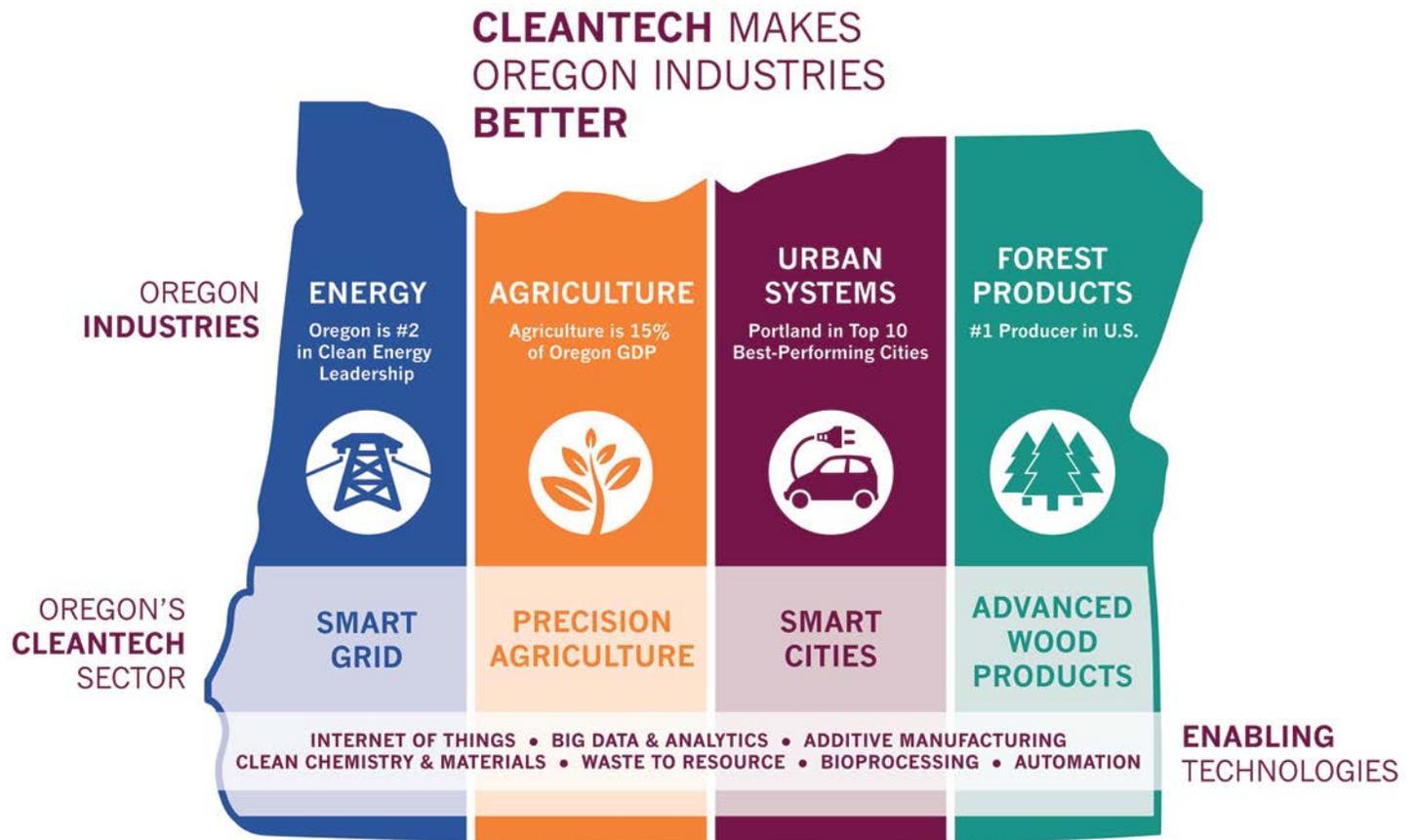


**Cleantech is good for Oregon**

- **Growing Market:** Cleantech is a large & growing market with global macro trends that favor long term growth
- **Manufacturing:** Cleantech creates white collar jobs (science & tech) and blue collar jobs (making hard goods)
- **Rural Jobs:** Cleantech jobs are geographically distributed and they improve the rural/urban economic balance

**Oregon is good at Cleantech and we are a national leader in this sector**

- **Policy Leadership:** Oregon is a national leader in sustainability thinking and supportive government policies
- **Green Consumers:** Oregon’s consumers are an ideal early-adopter market for local Cleantech companies
- **Natural Resources:** Oregon’s vast base of natural resource industries are synergistic with Cleantech
- **Expertise:** Oregon's university researchers generate a deep pipeline of Cleantech-focused research



**SOURCES:** Oregon Forest Resources Institute; Oregon Business Plan; CleanEdge "2015 US Clean Tech Leadership Index"; Milken Institute, "2015 Best-Performing Cities"

Cleantech is a cross-cutting industry sector well aligned with Business Oregon’s Target Industries. To drive widespread job creation, Oregon BEST proposes a uniquely Oregon focus on cleantech as a strategic area for state investment based on our existing strengths.

### Question 1: Make up of our organization or consortia

Oregon BEST is an independent nonprofit technology-based economic development entity that leads a statewide cleantech commercialization consortium with the partnership of the various collaborators below:

- University tech transfer offices, member researchers, and accelerators
- Formal incubator/accelerator partners that share pipeline, best practices, and mentors
- Joint programs with other statewide service providers such as SBDC and OMEP
- Investors that serve on Oregon BEST Commercialization Advisory Board
- Federal agencies that provide grants/contracts for our programs and support companies' tech development
- Utilities that partner with us on shared initiatives and sponsor programs

More detail on each of these connections in Appendix 1.

### Question 2: Connections to colleges, universities and/or other research entities in Oregon

Research collaboration is in our DNA. With member researchers, a network of labs, funded research projects, partnerships for tech transfer, and shared acceleration activities, Oregon BEST is deeply connected to universities and national labs. More detail on each of these connections in Appendix 2.

Oregon BEST Funding to Universities	# Projects	BEST Funding	Impact	Leverage Ratio
Research	60+	\$ 2.6M	\$ 37M of federal funding attracted	14:1
Commercialization	40+	\$ 5.4M	\$ 42.8M of follow-on funding from others	8:1

### Question 3: Top innovation opportunities for or barriers to growth in Cleantech

All areas of cleantech require extensive validation and demonstration projects.

	Barrier	Innovation Opportunity
<b>Smart Grid</b>	Electric vehicle adoption is limited by charging infrastructure	Develop a vehicle-to-grid demonstration project that will develop the software interfaces that demonstrate the efficacy of connected vehicles as a demand-response resource for utilities. This will add additional incentives for utilities to deploy EV charging stations and will drive accelerated adoption of electric vehicles.
<b>Smart Cities</b>	Urban systems challenges are large and complicated to tackle	Combine platform technologies with Oregon's leadership in open data systems as an IoT-enabled simulation environment. This will serve as an innovation enabler for local companies to pursue opportunities in: EV to grid, IoT, first mile/last mile transportation challenges, smart water/leakage, smart grid, smart streets. Oregon cities and towns would then serve as a test bed for Oregon solution providers to develop and prove out their technologies for export to communities globally.
<b>Precision Agriculture</b>	Fragmented smart ag technologies need integrated testing	Create a smart-farm-of-the-future demonstration farm with test bed for advanced AgTech. This facility would enable sensors, data analytics, autonomous vehicles, UAVs, irrigation, automated harvesting, and processing to be tested in a shared environment for improved systems integration.
<b>Advanced Wood Products</b>	Concrete and steel construction is Greenhouse Gas (GHG) intensive	With the goal of improving the balance of exports of logs with value-added forest products: Develop, test, and demonstrate advanced wood products, such as CLT and mass plywood panels, and the technologies that enable their use at a broader scale; develop, test, and demonstrate computer-aided design and manufacturing to support the use of wood in emerging paradigms for efficient offsite construction or prefabrication.

## Question 4: Cleantech alignment with the key evaluation criteria

### The opportunity to realize leverage

- **Market growth 5x in 10 years:** In 2010, HSBC Global Research estimated worldwide revenues for the clean economy at \$500 billion and predicted that this value could grow to \$2.3 trillion by 2020.
- **27x more investment globally over past 15 years:** Global investment in Cleantech has grown from \$1.07 B in 2000 to \$29.1 B in 2015. In that same period, investment in Oregon Cleantech has grown nearly 10x, from \$3.5 M to \$33.4 M in 2015. *Source: i3 Connect Database*
- **Many sources of leverage are seeking de-risked investments:** Cleantech investment by the state leverages federal grants (SBIR/STTR and other grants), private investment, strategic investment, and project finance, including: DOE, DOD, USDA, NSF, EPA, Utilities, HUD, DOT, VCs, Corporate Strategic.
- **Cleantech investment surge ahead:** Mission Innovation (a commitment by 20 countries including the U.S. to double R&D investment in clean energy by 2020), and the Breakthrough Energy Coalition, a collection of billionaires (including Bill Gates and Jeff Bezos) committed to investing \$2 billion in cleantech by 2020.

### Sector is uniquely attributable and/or has protectable links to Oregon

- **We have a head start:** The West Coast region is well advanced in terms of the clean economy and well positioned to receive its economic benefits. *Source: PEW Charitable Trusts Clean Economy Report, and GLOBE*
  - Of the total new **clean economy jobs** created in the U.S. in 2007, 21% were in CA, OR, or WA
  - Oregon has a progressive **government policy environment** supportive of the regional growth of cleantech
  - Oregon has **sustainability-minded consumers**- an excellent market of early adopters to support cleantech innovations
- **We have a strong pipeline:** Oregon has a vibrant community of active entrepreneurs and startups whose products have a direct or indirect cleantech component. Oregon BEST has over 100 such companies in its pipeline.
- **Cleantech = Manufacturing + Exports:** The Brookings Institution's report, *Sizing the Clean Economy*, confirms that the clean economy is manufacturing and export intensive with about 26% of all clean economy jobs offered by manufacturing establishments, as compared to just 9% in the broader economy. And on a per-job basis, cleantech companies export twice as much value per job as a typical U.S. company.
- **Manufacturing + Exports = Oregon:** Manufacturing is a critical part of Oregon's economy, and there are notable advantages to exporting from the state: "Oregon's proximity to the coast means the importing of raw materials and exporting of final products is more easily facilitated than in competitor regions." — *Oregon Business Plan*
- **Traditional Natural Resource Economy:** As the top producer of forest products in the country, and with an ag industry providing 1 out of every 8 jobs in the state, Oregon's agriculture and forestry industries are poised to take advantage of favorable investment trends for AgTech and bioproducts. See [\*AgTech Investing Overview 2015\*](#)
- **Oregon cities are already a recognized test bed:** Building off of the early policy leadership of Governor Tom McCall, Oregon municipal and private sector leaders have proven our state to be an effective testbed for innovation in land use, transportation, and green building.
- **Oregon is home to energy efficiency leadership:** The Bonneville Power Administration's Technology Innovation group, based in Portland, has inspired and funded some of the nation's leading energy-related research from right in our backyard. Combined with forward thinking utilities (PGE, NW Natural) and efficiency programs (NEEA, Energy Trust of Oregon), we are poised for continued opportunities for innovation in the energy sector.
- **Oregon has deep expertise:** OSU, PSU, UO and OIT all have world-renowned programs in cleantech that have created a robust pipeline of commercially relevant research; Oregon State University and PNNL are leading institutions in biomass, biochar, bioenergy, and bioproducts innovations; PSU, UO and PNNL are leading institutions in Smart Cities research; and OIT was the first university in the U.S. to offer a degree in renewable energy engineering.

## The level of impact of Oregon InC's investment on the industry's sector

- **State “gap funding” in this sector is critical to the success of startups in this sector:**

*“When it comes to longer term investments in R&D—such as those in renewable energies or energy storage—significant barriers remain...due in part to the short-termism of financial markets and the lack of early stage financing for innovative start-ups.”*  
— Angel Gurría, Secretary-General, OECD (Organisation for Economic Co-operation and Development)

- **Tech Development and Demonstration are key paths to impact in cleantech:**

*“A study by energy policy researchers Burer and Wustenhagen on clean technology venture capital investor preferences found that funding technology demonstration projects is preferred to all other forms of direct public policy interventions. This is because demonstration projects allow clean technologies to prove their performance potential and to test business model strategies in real market settings.”* — The West Coast Clean Economy, Pacific Coast Collaborative/GLOBE Research.

- **Oregon BEST has a track record of stewarding Oregon’s economic development funding:** As our 8:1 follow-on funding ratio suggests, we make investments that successfully increase Oregon companies’ competitiveness.

## Sector's ability to scale into significant jobs and/or revenue in at least the medium-term

- **Oregon is already benefiting from cleantech jobs:** According to the Brookings Institution, Oregon ranks second nationally in cleantech jobs per capita, with 3.4% of total jobs in the clean economy. It is projected that clean economy jobs for the pacific coast states will grow from 508,000 in 2010 to more than 1.5 million by 2020.
- **Cleantech creates manufacturing jobs:** Startup companies funded by Oregon BEST report 185,000 square feet of manufacturing space with significant growth in manufacturing forecasted.
- **Cleantech creates STEM-oriented jobs:** Cleantech products have a high content of engineering and scientific innovation, resulting in twice the rate of STEM-oriented jobs when compared with all U.S. occupations. *Source: Brookings-Battelle Clean Economy database and the US Bureau of Labor Statistics*
- **Cleantech creates rural jobs:** Nearly one-fifth of clean economy jobs, for example, involve agriculture and/or natural resource conservation. These include a variety of land and forestry management jobs, as well as those in organic farming. *Source: Brookings “Sizing the Clean Economy”*

## Question 5: Potential managers of High Impact Opportunities in Cleantech

Oregon BEST (all areas of Cleantech), Oregon Forest Resources Institute (Advanced Wood Products), NW Food Processors (Precision Agriculture), Technology Association of Oregon (Smart Cities), Drive Oregon (Smart Cities), SmartGrid NW (Smart Grid).

## Question 6: Examples of existing entrepreneurial activity in Cleantech

The Cleantech Group’s investment tracking database shows an increase in venture capital investment in the Cleantech sector from \$1.07 B in 2000 to \$29.1 B in 2015, representing an annualized growth rate of 24%. Oregon BEST currently adds 1–2 new Oregon startups or university research projects per week to its pipeline of product opportunities. Oregon BEST has supported the companies listed below with funding and support since 2011. *For more detail on the Oregon BEST database of companies and university technologies, see Appendix 3.*

Smart Grid	Oregon BEST Companies = 13	Companies in Pipeline = 21
Example Companies: Energy Storage Systems, eChemion and OpConnect		
Smart Cities	Oregon BEST companies = 12	Companies in Pipeline = 35
Example Companies: IOTAS, ParkIT, Lucid Energy, Arcimoto, and StormRegen		
Precision Agriculture	Oregon BEST companies = 10	Companies in Pipeline = 27
Example Companies: Honeycomb, SupraSensor and TryEco		
Advanced Wood Products	Oregon BEST companies = 5	Companies in Pipeline = 4
Example Companies: HM3 Energy, EcoPro Polymers, Formology, DR Johnson, City of Roses Disposal & Recycling		

## Question 7: Mega-trends or shifts that will drive growth in the Cleantech sector

*"The clean economy merits attention because its growth responds to worldwide megatrends associated with critical national and world challenges—notably the growing demand for global environmental sustainability, the sharpening need for resource security, and the aspiration everywhere toward economic transformation." — Bloomberg New Energy Finance*

### Climate change — demand for mitigation and adaptation strategies

The UN's historic COP21 Agreement among almost 200 countries is designed to address climate change impacts and it highlights that 'accelerating, encouraging and enabling innovation is critical for an effective, long-term global response to climate change and promoting economic growth and sustainable development'. Oregon's Renewable Portfolio Standard requires 25% of electricity sales from large utilities to come from renewable sources by 2025, and 50% by 2040. U.S. Sen. Jeff Merkley noted that "climate change is already wreaking havoc on our farming, our fishing and our forests, and we need to pivot rapidly from a fossil fuel economy to a clean energy economy."

### Global population and standard of living increase — demand for meeting growing needs with scarce resources

Global population is expected to reach 9 billion by 2040. Many resources including water supplies and available arable land are already strained. With growing demand, that drives the need to use limited resources more creatively and efficiently to ensure we can meet the needs of future generations. Precision Agriculture and other agricultural automation will be essential to gain significantly greater efficiencies in the agriculture sector.

### Urbanization — more people concentrated in urban environments, rapid construction of the built environment, and fewer people growing their own food

The rapid migration of population to urban areas is expected to drive population growth from 55.9% in urban areas in 2020 to 62% in 2040 and 65% in 2050. This will put pressure on transportation and other urban infrastructure which can be mitigated by Smart Cities technologies that harness software, sensors, big data and advanced analytics.

### New enabling technologies create opportunities for acceleration of cleantech innovations

Many cross-cutting core technologies are advancing rapidly and creating long-term opportunities for the development of products related to Smart Grid, Precision Agriculture, Smart Cities, and Advanced Wood. IoT, big data, and analytics have widespread applications in energy management, transportation infrastructure, and precision agriculture. Additive manufacturing breakthroughs are on the horizon and promise the manufacturing of high-performance parts from biomass-derived nanocellulose. Many new wood products are enabled by advances in waste material conversion and bioprocessing. Oregon has a deep pipeline of enabling technologies and promising research—in both its current industries and state universities—that can be harnessed to enable the development of many innovative products and companies, therefore growing prosperity in Oregon.



## Appendix 1:

### Detail for Question 1: Make up of our organization or consortia

Partner Type	Organizations
<b>Technology-Based Economic Development Entity</b>	Oregon BEST is a 501(c)3 with an independent Board of Directors
<b>University Partners via Master Agreements</b>	OSU, PSU, UO and OIT are University Partners
<b>Member Researchers</b>	277 Member Researchers at partner universities
<b>Formal Incubator/ Accelerator partners</b>	OTBC, RAIN Corvallis/OSU Advantage Accelerator, RAIN Eugene Accelerator, Portland State Business Accelerator, Fertilib Thinkubator, Sustainable Valley Technology Group, Cleantech Alliance of Washington, Wells Fargo IN2, U.S. Department of Energy's <a href="#">Incubatenergy Network</a>
<b>Joint Program Partners</b>	Oregon Small Business Development Center Network, Oregon Manufacturing Extension Partnership (OMEP)
<b>Investors on Oregon BEST Commercialization Advisory Board</b>	Element 8 Angels, Pangaea Ventures, Chrysalix Venture Capital, Peninsula Ventures, Phoenix Venture Partners
<b>Federal Agencies that provide Grants/Contracts</b>	U.S. Small Business Administration, Economic Development Administration (U.S. Department of Commerce), U.S. Department of Energy Regional Clean Energy Innovation Program (in pursuit)
<b>Utility Partners and Sponsors</b>	PGE, NW Natural, Bonneville Power Administration, Clean Water Services, Avangrid Renewables, Electric Power Research Institute
<b>Additional Collaborating Industry Organizations: Technology Association of Oregon, Oregon Entrepreneurs Network, Oregon Solar Energy Industry Association, SmartGrid Northwest, Drive Oregon, Oregon Wave Energy Trust, Northwest Energy Efficiency Alliance, Energy Trust of Oregon, Oregon Forest Resources Institute, Woodworks, Sustainable Northwest, Oregon Forest Products Working Group, Pacific Northwest Manufacturing Partnership (EDA-funded CLT Study Team), Oregon Forest Biomass Working Group, Oregon Forest &amp; Industries Council, Build Local Alliance, Cascadia Green Building Council, International Living Future Institute</b>	

## Appendix 2:

### Detail for Question 2: Connections to colleges, universities and/or other research entities

Oregon BEST Funding to Universities	# Projects	Funding	Impact	Leverage Ratio
Research	60+	\$ 2.6M	\$ 37M of federal funding attracted	14:1
Commercialization	40+	\$ 5.4M	\$ 42.8M of follow-on funding from others	8:1

Relationship	Organizations
<b>University &amp; National Lab Administrators with Seats on Oregon BEST Board of Directors</b>	OSU & UO Vice Presidents for Research, PSU Director for Innovation and Intellectual Property, OIT Associate Vice President, National Energy Technology Lab Acting Deputy Director; and until recently, Associate Director, Pacific Northwest National Lab
<b>Master Agreement for University Research</b>	OSU, PSU, UO and OIT are University Partners
<b>Oregon BEST Member Researchers</b>	<a href="#">277 Researchers at partner universities</a>
<b>Oregon BEST Lab Network:</b> 9 labs across OSU, UO, PSU	<a href="#">5 green building labs. 2 solar labs. 2 stormwater labs</a>
<b>Business Accelerators:</b> MOU for Collaboration	RAIN Corvallis/OSU Advantage Accelerator, RAIN Eugene Accelerator, Portland State Business Accelerator
<b>Student Projects:</b> Collaboration on Internships, Capstones and MBA Projects	OSU, PSU, UO, OIT collaborate with Oregon BEST to support startup companies through student-led projects
<b>Collaboration with National Labs</b> for Technology Commercialization and Validation	Pacific Northwest National Labs, National Energy Technology Lab