

3. Accelerating Decarbonization and Innovation in Montana's Economy, and Addressing the Needs of Workers and Communities in Transitions

Section I. Moving Montana's Economy to Net Greenhouse Gas Neutrality through Innovation and Advanced Manufacturing

A goal of the Council is to move Montana's economy to net greenhouse gas neutrality for average annual electric loads in the state by 2035 and economy-wide by 2050. To achieve these goals, Montana must accelerate the development and deployment of innovative technologies and practices in the energy, industrial, manufacturing, and agricultural sectors. The Council, thus, recommends establishing an innovation cluster initiative to assess, define, and support the needed environment, culture, workforce, and resource allocation to sustain state-wide efforts to achieve these goals. An innovation cluster initiative will help enable new, or nurture and grow existing, low and zero greenhouse gas emission industries across Montana.

Montanans live by an inherently innovative culture; according to the Kauffman Index of Entrepreneurship, Montana consistently ranks at or near the top for entrepreneurship and startup activity per capita. Building on a mindset that is inherent to who we are, an innovation cluster initiative will work to identify regional and state-wide capacity strengths, leverage lessons-learned and best practices from successes in sectors where Montana exhibits comparative and competitive advantages and grow what works.

Regional innovation clusters are defined below. But it is important to recognize these regional innovation clusters succeed when industry efforts align with existing capacity and focus among state agencies, the education system, industry associations, labor unions, economic development associations, and community leaders. The Council's recommendations below focus on the role the state can play in forging new partnerships, sharing information, and prioritizing strategic public investments in research and business formation.

Finally, efforts to understand innovation potential and cluster formation around net-zero emissions technologies and industries should be networked across Montana and supported by the broader intention of fueling Montana's "innovation landscape" and fostering culture, leadership, and environment that motivates and incentivizes public and private sector innovation.

Regional Innovation Clusters and Cluster Initiatives Defined

The Council drew on the work of the Brookings Institution and the writings of Harvard economist Michael E. Porter to define clusters. Regional innovation clusters are concentrations of interconnected businesses, supply chains, and service providers located in the same geographic area with coordinating intermediaries, and public institutions like universities or community colleges in a particular field. Clusters create synergies and drive growth by leveraging advantages of a specialized labor pool, suppliers that can serve special needs of multiple businesses, and “knowledge spillovers” among companies, business associations, and university faculty. The synergies associated with clusters often result in faster commercialization and growth of innovative technologies and services, driving growth in employment, wages, and revenue for the region.

To support industry clusters, several states have launched cluster initiatives. Cluster initiatives are coordinated efforts, motivated by state leadership, policy and funding, to accelerate and sustain growth of industry clusters. Cluster initiatives seek to build networks and dialogue among industry partners, universities, labor, philanthropy and other stakeholders to identify areas where strategic investments or shared information and resources will support private-sector growth that achieves public goals, including economic development and climate goals. Cluster initiatives may sponsor education and training activities, encourage relationship building, or facilitate market development through joint market assessment and marketing, among many others.

Net-zero greenhouse gas innovation clusters

The Council recommends that Montana launch cluster initiatives to decarbonize the state’s economy built around existing industries in the state and capacity among the state’s universities, community colleges, tribal colleges, and state agencies. Declaring decarbonization as a state goal provides a competitive advantage for Montana’s workers, businesses, and communities. Net-zero greenhouse gas innovation clusters will protect Montana’s economy, revenue, and jobs against future climate regulations. Decarbonization as an organizing goal will attract and retain business in our state i.e., entrepreneurs, investors, and industries who see innovation and decarbonization as a market, investment, and regulatory benefit. Montana also stands to benefit from a continuing national trend of advanced manufacturing and knowledge-based innovation sectors locating in smaller cities with access to global markets, an educated and skilled labor force, with quality of life and amenities business leaders and workers are seeking.

Montana’s innovation initiatives will draw on lessons learned among states and in Montana. The photonics cluster in Bozeman is an example of an industry cluster focused around technology developed jointly between Montana State University and local entrepreneurs. From small beginnings, this innovation cluster supported the creation of many private photonics businesses, collectively having substantial economic presence on our state and positive outlook for continued success and growth. The cluster arose organically because of synergies among basic research at the University and businesses. Strategic partnerships, shared material resources, and sustained research funding facilitated rapid growth.

Montana’s proposed innovation initiative would first explore how the state can apply lessons from established industry clusters and assess opportunities to nurture, expand, and grow emerging innovation clusters and secure the associated economic and climate benefits. An innovation cluster initiative would a) convene key partnerships and networks, b) make strategic public investments in basic research and early commercialization efforts that are often too risky or diffuse for the private sector,

and c) support the institutions that can sustain efforts over the years and decades sometimes required to achieve success.

Properties that should be present before public investments are committed include a critical mass of companies in a defined geographic region that interact synergistically. The synergies may be based on product and supply chains, occupations and skills, technology and specialized knowledge or other traits. The Brookings report on Rethinking Cluster Initiatives identifies five common traits of successful cluster initiatives: 1) they focus on a robust ecosystem to produce talent, innovation and economic opportunities, not just quick job gains; 2) they are typically industry driven, but with university involvement and government funding; 3) the initiative is willing to target resources at specific opportunities based on unique and legitimate strengths; 4) they have dedicated leadership; and 5) they have a physical center allowing significant interaction.

Montana's cluster initiative must be designed to overcome the limits of distance. Clusters benefit from proximity: industries, capital, and research institutions are most often located in the same city or region. Bozeman's photonics cluster is an example of how synergies develop from proximity and the easy flow of information, resources, and people between public and private sectors. Montana's precision agriculture, basic and applied research, and commercialization are occurring across wide distances and requires new approaches to networking and leveraging shared assets. Montana's innovation initiative can build capacity in unique ways that could become the standard for uniting the state with growing research and technology innovation centers with rural areas where natural resources, skilled labor, and business innovation are located.

Montana's competitiveness will stem from continued assessment and assembly of a state-wide "innovation landscape" that engenders a culture among community and state leaders that motivates and incentivizes innovation. A robust innovation landscape provides the institutional framework that would coordinate the partnerships and relationships, funding and investment capital, and place-based roundtables identifying and driving forward industry clusters when they get started.

The Council recommends learning from the success of existing innovation clusters and applying these lessons to accelerate growth and deployment of nascent clusters that will help achieve the state's climate goals. Further, the Council recommends six possible regional industry technology development efforts that could be nurtured to form innovation clusters. These efforts build on existing strengths in our state's energy, academic, industry, technology, and agricultural sectors.

1. **Northwest Montana Mass Timber and Wood Products Manufacturing Innovation.** This region has an existing industrial cluster that includes SmartLam, FA Stoltze, and Idaho Forest Group. The University of Montana has research capacity to support innovation in mass timber construction, wood fiber insulation, and other low and negative carbon technologies. State and Tribal community colleges, including Western, Bitterroot College, Blackfeet Community College, and Salish Kootenai College add capacity in workforce and skills training and apprenticeship and institutional capacity to convene college, community, tribal, and industry leaders.

Advanced wood products manufacturing aligns with adaptation efforts to thin small-diameter trees to manage wildfire risk around communities in Montana. Wood building materials also sequester carbon in buildings, reducing emissions from concrete construction. These efforts

would grow the state's industrial capacity and workforce in the timber and manufacturing sectors and generate income and revenue in rural communities.

- 2. Southwest Montana Renewable Hydrogen and Advanced Energy Storage Innovation.** A significant proposal from Mitsubishi-Hitachi to establish an electrolysis plant in Butte creates opportunities to establish research capacity to deploy a new, world-leading method for energy storage and electricity generation. The electrolysis process planned would use excess renewable electricity capacity seasonally to split water into hydrogen and oxygen. The hydrogen could be stored seasonally and used to generate electricity when demand exceeds renewable energy capacity. Montana already has a nascent cluster around REC Silicon Inc., the nation's sole supplier of silane gas critical in the manufacture of next generation lithium ion batteries and anodes, and research capacity located in Butte. Aligning research capacity at Montana Tech and Montana State University with the industry-led novel technology innovation could help advance and accelerate growth in battery technology and expand industrial applications of hydrogen—including heavy duty vehicles, rail and equipment, home heating, and manufacturing processes.

Electrifying Montana's economy and eliminating emissions from the electricity sector requires continual advancement in short-term and seasonal energy storage at a distributed and utility scale. The energy storage systems industry is expected to grow 20-fold from current levels by 2030. Designing and deploying these technologies in Montana will help meet the state's climate goals and offers significant opportunity to grow and establish new businesses. The large industrial proposal from Mitsubishi-Hitachi also represents a significant opportunity to develop new skills and job markets for Montana labor.

- 3. Eastern Montana Net-Zero Manufacturing Innovation.** The long-standing industrial cluster in Billings provides an opportunity to decarbonize existing industries through innovation and a networked approach to industrial processes, carbon capture and storage, and renewable energy innovation and deployment. Large-scale industrial processes will continue to need utility scale power generation, but innovation in industrial and manufacturing processes to decarbonize the regional industrial cluster could expand capacity to attract new, low-carbon industrial development.

Co-locating industrial processes can utilize waste-heat and make carbon capture and storage economic, reducing or eliminating greenhouse gas emissions from large-scale industrial processes. Decarbonizing Montana's industrial cluster in Billings will reduce greenhouse gas emissions, protect the state's economy from potential carbon regulations, and attract new investment and industry who see decarbonization as a market, financial, and regulatory benefit.

- 4. Northern Plains Precision Agricultural and Soil Carbon Innovation.** A Northern Plains precision agriculture and soil carbon innovation cluster would build on and expand research capacity at MSU Northern and MSU Bozeman. Building on successful research and technology integration efforts at Montana State University, new technology innovation can be developed when decarbonize agricultural processes and sequester carbon in soils are the focus of the work. By working with industry, technology providers, and agricultural producers, MSU can better

understand technology improvements and opportunities for research demonstrations to underpin impact statements.

Agriculture remains an important sector in Montana's economy and culture and is a key sector with potential to produce negative greenhouse gas emissions by decarbonizing industrial processes and sequestering carbon in soils.

5. **Central Montana Renewable Energy Innovation.** Montana has substantial renewable energy generation and storage potential of wind, solar, pumped-storage, and renewable hydrogen. Locating an innovation cluster around existing institutional and industry capacity in Great Falls, Havre, and Harlowton can accelerate the technology, infrastructure, and projects that will be needed to decarbonize Montana's electricity system and maintain and expand the state's position as an energy exporter.

6. **Southwest Montana Biofuels Innovation.** This cluster will target creating the technologies and scale-up capabilities required for large-scale biofuels manufacture. A key goal is to minimize or eliminate the use of diesel fuel derived from non-renewable sources, a major source of carbon emissions for our state. Diesel is used to fuel large vehicles (e.g., for trucking, agriculture, construction) and, most importantly, to fuel jet travel. Electrifying such vehicles, an especially positive move if it could be done with solar- or wind-derived energy, is hindered by energy needs and current battery capacity. Thus, development of biodiesel and biojet fuel manufacturing will be a key focus of the biofuels innovation cluster. The cluster will include existing capacity at UM-Missoula, MSU-Bozeman and MSU-Northern (e.g. Energy Research Institute, Chemical Engineering, Plant Sciences, Forestry, others), the Northwest Advanced Renewables Alliance, private industry, agricultural producers, and labor. The emphasis will be on the creation of diesel and biojet fuel from Montana-sourced feedstocks (e.g. wood products waste, ag production waste, crops grown specifically as biofuels sources such as safflower, camolina, and algae).

The Council acknowledges that not all innovation initiatives will lead to successful, sustained industry clusters. On the other hand, there are several steps that can be taken to support the growth, development, and success of existing nascent clusters. Any new policy direction related to innovation clusters must also be flexible and responsive to identify and support new clusters not identified by the Council's work to date.

The following recommendations include steps the state can take to assess the viability of regional innovation clusters and to build capacity to coordinate innovation initiatives across the state. The recommendations draw on lessons learned from existing industry clusters in Montana and from existing work and capacity in state agencies and the university system to coordinate and advance research and business development in innovation sectors. Additionally, some aspects of the Innovation Landscape are influenced by policy, particularly the *Innovation Environment* and the *Culture*. The state should investigate best practices in jurisdictions with strong Innovation Landscapes to develop policies that: create competitive business and regulatory environments; foster effective fiscal incentives; and provide financial and infrastructure incentives to promote business growth. The design of the policy environment can support innovation in market formation (for example, energy balancing markets).

Strategies should focus on actions the state can take to create, coordinate, and support innovation initiatives, including roundtables organized around new partnerships, collecting and sharing information, and prioritizing research and public investments.

3A: MONTANA, LED BY THE MONTANA SCIENCE AND TECHNOLOGY COMMITTEE AND THE OFFICE OF THE COMMISSIONER OF HIGHER EDUCATION, SHOULD IDENTIFY KEY OPPORTUNITIES FOR TECHNOLOGY-LED ECONOMIC DEVELOPMENT, PRIORITIZING AREAS THAT ASSIST WITH CLIMATE CHANGE TRANSITIONS AND MITIGATION

Key Strategies:

- Revise and update Montana's Science and Technology plan with a focus on industry linkage opportunities and opportunities to foster and sustain competitive industry/university collaborations in basic and applied research.
- Within identified areas of strength, charge and fund key networking organizations (i.e. industry organizations, university research centers, or state agencies) with regularly convening key university/industry/society players.
- Within the Montana University System, institute seed-granting opportunities and research capacity building efforts to grow the state's university expertise and competitiveness in each identified area of strength.

3B: THE MONTANA LEGISLATURE SHOULD INVEST IN INITIATIVES THAT BUILD UNIVERSITY/INDUSTRY/SOCIETY INNOVATION LINKAGES TO ADDRESS KEY MONTANA CHALLENGES, INCLUDING CLIMATE CHANGE

Key Strategies:

- Institute a state-funded grant program to further develop research capabilities and user facilities at Montana's public universities, with a goal of leveraging these facilities to grow innovative Montana-based technology development companies and clusters.
- Develop a recruitment and retention funding pool for strategic growth in research capabilities in key areas of state need.
- Appropriate further rounds of funding for the Montana Research and Economic Development Initiative to encourage applied research addressing Montana needs.
- Set aside a match-funding pool to increase Montana researcher's competitiveness when pursuing federal grant dollars and capitalize on existing federal and state tax incentives and work to create new incentives where deemed appropriate.
- Develop / Identify and appropriately fund a research center or institute charged with networking and organizing university research and university/industry linkages statewide in the area of energy innovation. Key areas of focus based on Montana's industry and existing research

expertise may include biofuels, energy storage, transportation grid electrification, and energy related agricultural practices.

- Utilize and bolster existing apprenticeship programs at state agencies in Montana to transition and prepare Montana's workforce for innovation sectors.

3C: WORK TO ESTABLISH MULTIPLE REGIONAL INNOVATION CLUSTERS IN MONTANA FOCUSED ON DECARBONIZATION OF MONTANA'S INDUSTRIES BY 2035.

Key Strategies:

Resource and convene state-wide innovation initiatives with university, state agency, private industry, labor, finance, and non-profit sector leaders to assess the viability of innovation clusters. These initiatives should begin with regional roundtables focused on assessing the viability of six emerging regional innovation clusters listed below. Other regional clusters may well emerge as the roundtables convene, however the six listed have been identified through the work of this Council as areas where, to some extent, private and public research, development, and commercialization of innovations that will help decarbonize Montana's industries is already occurring or has good potential for success:

- Northwest Montana Mass Timber and Wood Products Manufacturing cluster
- Southwest Montana Renewable Hydrogen and Advanced Energy Storage Cluster
- Eastern Montana Net-Zero Manufacturing and Industrial Cluster
- A Northern Plains Precision Agriculture and Soil Carbon Innovation Cluster
- A North-Central Montana Renewable Energy Innovation Cluster
- A Southwest Montana Renewable Fuels Innovation Cluster

Over time, identify a cross-sector team, emerging either directly from government or as a public/private partnership or non-profit, charged with and resourced to support nascent cluster initiatives.