



**CARBON NEUTRAL CITIES ALLIANCE (CNCA) INNOVATION FUND  
SUMMARY OF ROUND 3 PROPOSED PROJECTS**

|   | <b>Lead City</b> | <b>Proposed Project Title and Idea Summary</b>   | <b>Amount Requested (USD)</b>  |
|---|------------------|--|--|
| 1 | Yokohama         | <b>Yokohama Blue Carbon.</b> Researching how to increase carbon sequestration through the conservation and rejuvenation of seagrasses, such as Kelp and Wakame.  | \$100,000 (1-year request only)  |
| 2 | Portland         | <b>Automated Vehicle (AV) Deployment Policies.</b> Evaluating the effectiveness of various automated vehicle (AV) deployment policies and regulations crafted specifically to achieve carbon reduction goals.  | \$100,000 (1-year request only)  |
| 3 | Portland         | <b>Sustainable Consumption.</b> Harmonizing various approaches for creating consumption-based emissions inventories (CBEI) and bringing their use into the mainstream, to develop and prioritize targeted GHG reduction activities.  | \$115,000 (1-year request only)  |
| 4 | Vancouver        | <b>ZEB Centre.</b> Creating the Zero Emissions Building Centre (ZEB) of Excellence as a central hub to showcase early leaders in zero emissions buildings, sharing their learnings with others in the industry, and offering training, resources and support. The Centre is expected to accelerate learning and build a community of practice among zero emissions building practitioners. | \$225,000 USD over 3 years (\$75,000/yr., subsequent years' contingent on performance) |
| 5 | San Francisco    | <b>EV Charging Infrastructure: Phase II.</b> Building on 2016 USDN Innovation Fund work and pioneering access to carbon market funding for city EV charging projects to address the problem that no profitable business model has yet emerged to scale up such infrastructure installation.  | \$150,000 (1-year request only)  |
| 6 | San Francisco    | <b>Achieving Climate Action Goals through Waste Prevention.</b> Clarifying and filling the knowledge gap around how changing producer or consumer behavior to reduce single use disposables can impact city greenhouse gas emissions.  | \$60,000 (1-year request only)   |
| 7 | San Francisco    | <b>Electric Vehicles and New Mobility Service Sectors -Workforce Education and Training Needs.</b> Identifying equitable workforce training, curriculum and job placement needs to support new urban mobility industries such as electric, shared and autonomous vehicles (AVs).   | \$110,000 (1-year request only)  |
| 8 | Sydney           | <b>Urban planning for energy emissions and comfort.</b> Developing tools to maximize the effectiveness of urban planning instruments and processes to deliver deep emissions reductions.   | \$88,900 (1-year request only)   |
| 9 | Sydney           | <b>Net-zero heroes.</b> Enabling market transformation for net-zero emissions by mobilizing business and residential communities consistently and at scale.  | \$80,000 USD over 3 years (\$26,667 /yr., subsequent years' contingent on performance) |



|    |               |   |                                 |
|----|---------------|---|---------------------------------|
| 10 | New York City | <b>Thermal Decarbonization Initiative.</b> Phasing the Thermal Decarbonization Initiative for Cities for local supply chain development and contractor training. This is part of a multi-year effort to scale up the market for cold-climate electric air source heat pumps (ASHPs)—a critical component of each city’s climate goals.  | \$250,000 (1-year request only) |
| 11 | New York City | <b>High Performance Hub.</b> Building on an existing collaboration between New York City and Vancouver (initially funded by CNCA), New York, Vancouver and Washington D.C. seek support to create a scalable education and information network of energy efficiency resources that provides guidance for building owners looking to complete deep, holistic retrofits of their buildings, or build new high performance projects, with materials that are specifically relevant to the challenges and needs of partner CNCA cities. | \$250,000 (1-year request only) |
| 12 | Seattle       | <b>Human Centered Design (HCD):</b> Changing the way cities approach solving climate issues by working with teams to cultivate a human-centered design mindset and equipping them with a human-centered design toolset.   | \$100,000 (1-year request only) |
| 13 | Seattle       | <b>HVAC System Energy Performance.</b> Developing model code language (with an associated digital compliance tool) that create a single minimum efficiency standard for each building’s entire HVAC system.   | \$200,000 (1-year request only) |
| 14 | Toronto       | <b>Collective Impact: Resident Mobilization for Behaviour Change.</b> Understanding the potential of collective action and social innovation frameworks for mobilizing diverse residents to participate in programming across issue areas in ways that support deep decarbonization.  | \$110,000 (1-year request only) |
|    |               | <b>TOTAL ESTIMATED REQUEST</b>  | \$1,938,900                     |

## Proposed Project Summaries

### Proposed Project 1. Yokohama Blue Carbon Project

- Chika Onodera

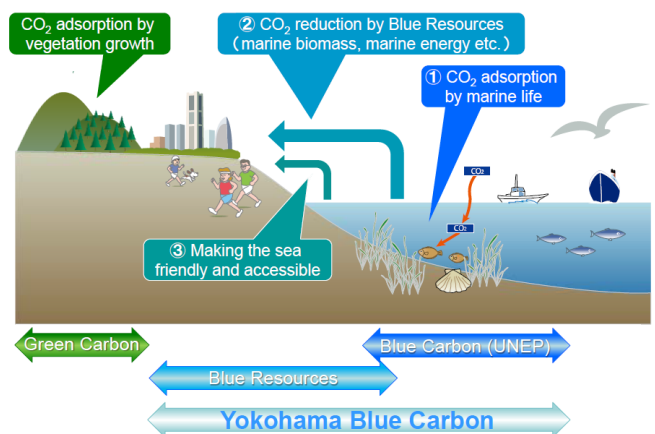
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- Consultant / partner / Other participating cities: TBC

The City of Yokohama has been pioneering an ambitious and unique initiative called “Yokohama Blue Carbon.” Blue carbon is a concept that was put forth by the United Nations Environment Programme. It focuses on the possibility of increased carbon sequestration by the conservation and rejuvenation of mangroves, salt marshes and seagrass. We in Yokohama have taken the blue carbon concept a few steps further. Not only do we preserve seagrass in the ocean, but we also seek to utilize coastal energy sources by the use of ocean water heat pumps for district heating, the use of efficient electric power supply for parked ocean vessels, and the use of LNG Tug Boats.<sup>1</sup> Additionally, we also encourage local consumption of edible seagrasses such as Kelp and Wakame. We call them “blue resources.” The effective use of blue resources should result in significant carbon offsets by limiting GHG emissions. Furthermore, the “blue carbon” and “blue resources” concepts help to highlight the daily involvement of Yokohama’s coastline in the lives of its citizens. The Yokohama Blue Carbon project takes a holistic approach that consists of 3 main focus points: blue carbon, blue resources, and the promotion of ocean stewardship among our citizens.

One major feature of our Yokohama Blue Carbon initiative is its own carbon offset program. This program creates carbon credits that allow the World Triathlon Series (WTS) in Yokohama to offset some of its carbon footprint. The carbon credit is gained through promoting local consumption of local Wakame, lessening the need for its transport.<sup>2</sup> The savings in CO<sub>2</sub> output from the reduction of long-haul shipment is calculated as a carbon credit, in this case. The system operates like this: (1) The contestants pay an extra environmental contribution donation to register for the games; (2) The funds collected pay for carbon offsets for the emissions caused by contestant’s transport and game operation; and (3) The reduced CO<sub>2</sub> output is monetized as carbon credit, and then traded to



benefit further local production of Wakame, and to preserve oceanic health. The WTS games serve to promote and enrich the culture around the coastline of Yokohama. We seek to widen the circle of involvement among local businesses and universities in implementing such systems. The list of targeted co-benefits of the Yokohama Blue Carbon initiative is comprehensive. It will result in: (1) improved water quality; (2) diversification and maintenance of plant life on the environmental front; (3) improved amenity and advancing of the “Yokohama” brand on the social front; and (4) on the economic front, increased local production of food stuffs, and a likely boost in tourism.

The Paris agreement adopted at COP21 requires each country to renew and report their Nationally Determined Contributions (NDC) every 5 years. Many countries mention blue carbon or utilization of shallow water ecosystems

<sup>1</sup> 30% less CO<sub>2</sub> output compared to conventional Marine Fuel Oil driven Tugboats. Began commercial use in Yokohama port in 2016.

<sup>2</sup> Seagrasses, such as Kelp and Wakame are a common food item in Japanese cuisine, often used to produce healthy ‘umami’-filled soup stock.



in their NDC.<sup>3</sup> The focus on utilizing blue carbon for climate mitigation is increasing. However, for blue carbon to be universally trusted as an objectively reliable tool for carbon sequestration, quantifiable scientific measurements need to be made. These measurements will give us a deeper understanding of the mechanisms behind the sequestration process. Unfortunately, research organizations find it difficult to gather funds for this important research. This is because oceanic research relating to blue carbon is a relatively new field that often requires ships and exclusive equipment, resulting in high project costs. This is one of the primary reasons why research organizations find it difficult to secure enough funds. The mechanism of carbon sequestration in shallow water ecosystems is complex. The research will involve examining the interrelationships of the specific region's carbon-flow, plant species diversity, and atmospheric conditions. The currently available blue carbon sequestration rates<sup>4</sup> are estimates calculated for large seagrass carbon sequestration on a global scale.

We are applying for a Carbon Neutral Cities Alliance (CNCA) Innovation Fund grant to advance our research in the area of blue carbon sequestration by large seagrass. We will use the funds to do field research (such as water and sediment sampling and analysis) to find measured carbon sequestration rates by large seagrass in the coastal waters of Yokohama. We are teaming up with the Port and Airport Research Institute (PARI), which is already involved in the Yokohama Blue Carbon project. They have just begun research on the blue carbon effect for locally produced kelp, and their contribution to this field of research is very welcome.

Carbon sequestration rates in shallow water seagrass beds is known to be much faster compared to terrestrial plants. If we can further investigate the mechanism behind the absorption and securing of carbon, this research can be tied to successful reduction of CO<sub>2</sub> in our atmosphere. The research findings will be shared with other CNCA cities, most of which are coastal, so these cities could directly benefit from this work. Because half of all countries in the world have made clear in their NDCs that they are using their ocean for climate mitigation measures, we are convinced that the findings from our blue carbon research project will contribute to atmospheric carbon reduction. All cities, including non-coastal cities, will reap benefits through the wide-spread impact of this effort.

If awarded, we will utilize some of the funds to promote the concept of ocean stewardship. We will first formulate and promote the Yokohama Blue Carbon initiative in tangible and easily understood ways for our citizens. Through this, we expect that our citizen groups will gain a heightened awareness of the benefits of the ocean. Then we can expect that more of our citizen groups and private sectors will utilize ocean resources for climate change initiatives. Citizens and companies that care about climate change can help spread the use of our own carbon offset program, which can be utilized almost anywhere, also in non-coastal regions. For example, the WTS games are participating in our carbon offset program to minimize their carbon footprint. We are currently strategizing how best to widen the use of our carbon offset program model so it benefits the other 9 cities that are involved in the WTS.<sup>5</sup>

By spreading the word about ocean stewardship in concrete terms to our citizens, and by pairing up with a respectable research organization to gain valuable insight into blue carbon, we can accelerate the "Blue Resources" initiative and widen the use of our carbon offset system to achieve deep reductions in CO<sub>2</sub> emissions in our city. By doing what we seem to do best - collaborating with our stakeholders - we plan to build a replicable model and share the results.

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3 Of the countries that list blue carbon in their NDCs, 19% of countries mention it as a carbon mitigation effect, and 39% mention it as an adaptation effect.

4 Dorte Krause-Jensen and Carlos M. Duarte "Substantial role of macroalgae in marine carbon sequestration" (nature geoscience 9, 737-742(2016) <http://www.nature.com/ngeo/journal/v9/n10/abs/ngeo2790.html> )

5 WTS 2017 series are in Abu Dhabi, Gold Coast, Yokohama, Leeds, Hamburg, Edmonton, Montréal, Stockholm, and Rotterdam.



## Proposed Project 2. Portland Automated Vehicle Deployment Policies

The City of Portland, Oregon, the Natural Resources Defense Council (NRDC) and the Southern California Association of Governments (SCAG) are providing an update to our original Letter of Interest sent in April for the Carbon Neutral Cities Alliance Innovation Fund for 2017. We are continuing to develop a proposal that evaluates the effectiveness of various automated vehicle (AV) deployment policies and regulations that are crafted specifically to achieve carbon reduction goals. The widespread use of AVs poses both opportunities and challenges. AVs could decrease traffic fatalities, increase the adoption of electric vehicles, and provide mobility services to disadvantaged communities. They also have potential to significantly increase transportation carbon pollution. One recent evaluation of nine regional travel demand models showed a possible increase of 68% in vehicle miles traveled (VMT), up to 26% increase in vehicle trips, and as much as a 43% reduction in transit trips.

Portland and other cities are developing policies and test projects to increase the likelihood that AV and TNC vehicles advance our safety, climate, and equity policy goals. However, we face a knowledge gap: which policy and management levers are most likely to cut vehicle carbon pollution? We will develop a proposal to evaluate policies such as dynamic congestion pricing, right of way management, and behavioral economic strategies for potential carbon reduction effectiveness. We would also like to analyze the political viability of these strategies and how they might be received by the private sector.

We know that for any US city to meet its transportation related carbon reduction goals, we will need to promote transportation choices that result in a reduction in the “empty miles” from single-occupancy vehicle (SOV) and zero occupant vehicle (ZOV) driving. Empirical evidence from around the world suggests that congestion pricing policies have been more effective than other policy mechanisms at nudging commuters away from SOV driving and towards more sustainable transportation choices such as transit, walking and biking. While exploring congestion pricing as a tool to manage the potential VMT and carbon impacts of AVs, we are also interested in exploring how congestion pricing could contribute to a reduction in personal SOV driving, which remains the lions share of all VMT. We have a short time window to implement AV policies and practices before widespread deployment makes a strong regulatory framework more challenging. Policies such as congestion pricing, which have been politically difficult to introduce in existing transportation systems, may find an easier entry point with a new technology such as automated vehicles.

Portland, OR is already working to implement AV congestion pricing into planned AV pilot activities. The city has posted for comment a draft AV permit, which requires AV companies to pay a number fees including both a congestion fee within highly congested areas of the city, and a general road user and vehicle fuel efficiency charge for all other areas. However, these charges are theoretical currently since Portland has not yet launched a pilot and has not identified a technology to collect the fees. The Southern California Association of Governments has also been working to explore the technical and political feasibility of mobility pricing policies in an effort to tackle Los Angeles' notorious traffic congestion. SCAG has been developing a concept of operations.

If this cohort were selected to receive CNCA funding of \$100,000 or more, the proceeds could fund of up to four activities to support the implementation of AV congestion pricing:

- Evaluation of a range of pricing approaches for both Portland and Southern California to determine which are most likely to reduce climate pollution and congestion from SOV trips;
- Evaluation of fee collection technologies to be used during pilot activities;
- AV pilot design that includes congestion pricing elements; and
- A public engagement campaign for congestion pricing, including any authorizations required from any other government entities.

Portland, OR and Southern California are the core areas for this proposal, and the Natural Resources Defense Council (NRDC) is providing guidance as we continue to develop a final proposal. Observing cities at this time



include London, UK, Stockholm, SW, Auckland, NZ, Vancouver, BC, Washington, DC, Chattanooga, TN, Nashville, TN, Miami, FL, Seattle, WA, Los Angeles, CA, San Jose, CA and San Francisco, CA. We believe that this work would be applicable to any city contemplating how to incorporate AVs into their transportation system. The primary contact for this grant proposal will be Ann Shikany, Senior Analyst, Legislative and Resource Development, Portland (Oregon) Bureau of Transportation; [Ann.shikany@portlandoregon.gov](mailto:Ann.shikany@portlandoregon.gov); 503-823-2417 and Portland's primary CNCA member is Michael Armstrong; [Michael.Armstrong@portlandoregon.gov](mailto:Michael.Armstrong@portlandoregon.gov); 503-260-2570.



## Proposed Project 3. Portland Sustainable Consumption

### *Consumption and Urban De-carbonization: New Tools and Approaches*

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**Other participating (observing) cities:**

Vancouver, BC; Stockholm, Sweden; Oslo, Norway; San Francisco, USA

**Project Description:**

The purpose of this project is to harmonize the various approaches for creating consumption-based emissions inventories (CBEI) and bring their use into the mainstream to ultimately support the development and prioritization of targeted GHG reduction activities.

Within cities, a deeper understanding of how consumption patterns drive climate change is emerging, bringing with it new analytical tools through which to view GHG reduction opportunities. CBEI employ a comprehensive approach by accounting for emissions associated with local consumption of goods and services, regardless of where they were produced. As a complement to more traditional GHG inventories, CBEIs reveal unique and potentially significant GHG reduction opportunities, including:

- Consider new, more comprehensive community GHG reduction goals;
- Target carbon intensive consumption categories and activities; and,
- Inform campaigns to shift consumer consumption behaviors from carbon intensive behaviors to those with lower emissions.

A number of different CBEI methodologies have been developed in recent years including 1) CBEI model for Oregon that produced a state-level inventory as well as inventories for the cities of Portland and Eugene; 2) Cool Climate model used by San Francisco and other Bay Area cities; 3) CBEI model for C40 member cities, and 4) the ecoCity Footprint tool for Vancouver, BC. While vanguard cities are innovating in this area, there is currently no standard for CBEI or easily accessible protocol that would allow diffusion of the practice.

This project will: 1) evaluate the various CBEI methodologies to highlight key insights, lessons learned and best practices, 2) refine analytical methods and tools for estimating GHG reduction potential of actions targeting consumption, and 3) inform multiple reporting platforms and measurement protocols. Project components include:

- Meta-analysis that reviews, compares and contrasts various CBEI approaches used to date;
- Expansion and refinement of models for estimating consumption related GHG reduction scenarios (see for example: <http://sei-us.org/publications/id/464>); and,
- Workshop for partners to discuss project results, potential harmonization of efforts and develop a path toward developing a common standard.
- Framework for cities to develop actions that target the biggest opportunities for impact.

**Project Objectives**

Cities can no longer ignore the impacts of consumption in their climate action planning. A consumption-based emissions inventory is a useful tool for illustrating the consumption-climate connection but to date, it hasn't been broadly applied. Thus, project objectives include:



- Create a gold standard for using CBEI alongside traditional sector-based GHG reporting;
- Identify best practice to inform a unified set of standards that can be readily adopted for GPC and other reporting platforms;
- Work with leading partners who will drive rapid adoption of the new standard (ICLEI, CNCA, Oregon DEQ, C40, USDN have all expressed interest);
- Build on the work of the Stockholm Environmental Institute to produce a calculator for estimating GHG reduction potential in high impact areas such as food, goods, services, construction, home energy, and personal transportation.
- Provide cities direction and guidance for how to integrate CBEI results into community climate action planning.

### **Transformational Impact**

Cities have decarbonization levers that aren't visible through a traditional sector-based emissions inventory. Looking through a consumption lens not only affirms existing actions but also reveals new high impact opportunities. Consumption-based emission inventories typically show total emissions to be roughly two times greater than traditional sector-based measurement, with over half the emissions coming from the consumption of food, goods and services. The remainder comes from home energy use and transportation fuels - the traditional focus of many urban sustainability programs.

Conducting CBEI reveals the carbon intensity of specific consumption activities, allowing cities to target those with the greatest GHG reduction potential. This can drive a whole new set of market interventions, community investments and behavior change campaigns, and with it, significant emission reductions.

Some examples of how CBEI has refocused action at the state and local level:

Oregon Department of Environmental Quality: A statewide CBEI revealed that the consumer products with the highest emission intensities (emissions/\$) included appliances, food and clothing. As a result, DEQ prioritized:

- Food: profiling life-cycle assessment studies of specific foods; conducting research and developing a campaign for local governments on preventing the wasting of food.
- Clothing: developing a waste prevention campaign for local governments; engaging in work force development to support clothing repair; researching other potential interventions to reduce emissions from textile production and use.
- Smaller houses: conducting research and partnering with the building industry to promote smaller houses to reduce material and energy inputs.

### **Portland, Oregon**

The City's CBEI confirmed that "global emissions as a result of local consumer demand are more than twice the volume of emissions produced locally." The analysis prompted new actions in the 2015 update of the Climate Action Plan, including a call for developing a local sustainable consumption strategy. It also affirmed policies to promote smaller housing, including reduced system development charges.

Armed with new and compelling information about the impacts of consumption, cities around the world can adopt new approaches to GHG reductions including engaging community on issues like food choice; directing investment to shared resources like tool lending libraries; and focusing economic development activities to support the repair industry and remanufacturing.

This project will capture a strategic opportunity to advance the practice of CBEI from innovation to standardization and inform and enhance the next generation of global de-carbonization efforts.





## Proposed Project 4. Vancouver Zero Emissions Building Centre of Excellence

### Contact Information (CNCA primary member)

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### Consultant / partner to provide the services - TBD

### Other participating cities

*Core Partners:* We will be working closely with staff from New York City, New York’s Building Energy Exchange, as well as Washington, D.C., in refining the scope and launching Vancouver’s Center of Excellence. Vancouver’s collaboration with New York City was established through a CNCA Innovation Fund project in 2015 (“Accelerating Market Transformation to High Performing Building Envelopes in North American Cities”), and has been ongoing ever since. Staff from the Building Energy Exchange recently participated in a workshop hosted by the City of Vancouver to shape the Centre of Excellence’s work plan. We intend to continue working together once the Centre is operational, such we can share best practices, resource guides, training events, and peer-to-peer learning opportunities. The Centre of Excellence will facilitate access for our local practitioners to relevant resources and events offered by the Building Energy Exchange and Washington, DC, and vice versa.

*Additional Collaboration:* We’ll also be collaborating with other non-CNCA cities pursuing aggressive zero-emissions building programs. In particular, the City of Vancouver is working closely with local governments and private sector leaders from the cities of Vienna and Brussels, both of which have had considerable success with zero emissions buildings and are keen to share their knowledge and learnings.

### Project Description

In July, 2016, the City of Vancouver adopted its Zero Emissions New Building Plan. The overall goal of the Plan is that, by 2025, the vast majority of new buildings in Vancouver will be built to a zero emissions standard. To achieve that, the Plan lays out an action plan that includes progressive regulatory changes, incentives, and a commitment by the City to build its own facilities to a zero emissions standard. Vancouver Council also approved CAD \$700,000 towards the creation and operation of a central resource hub for designers and builders, to accelerate learning and knowledge sharing across the industry. The City’s funding is contingent upon staff securing matching external funds. To date, staff have secured CAD \$325,000 in grant funding.

The Zero Emissions Building Centre of Excellence is expected to launch this fall. It will be operated by an existing third-party organization, with expertise in green buildings and an established network of partners across the building industry. The host organization will enter into a contract with the City to hire staff, secure physical space, and deliver programming. The Centre is expected to operate until at least 2025. The City is aiming to provide the host organization with secure funding for at least three years of operation (estimated at approximately \$1.5M over the three years), after which the Centre is expected to be supported in part by the building industry itself, along with other government and non-government partners.

The role of the Centre will be as a central hub to showcase early leaders in zero emissions buildings, share their learnings with others in the industry, and offer training, resources and support. The Centre will also serve as a space for dialog for local developers, designers and builders to identify the key barriers they are facing, which the Centre’s staff will then be tasked with seeking out solutions for. Solutions may include advocating for regulatory improvements, new training opportunities, or catalyzing research to address knowledge and innovation gaps. Through these activities, the Centre is expected to accelerate learning and build a community of practice among zero emissions building practitioners.



Vancouver is ideally positioned to host such a Centre. The City has a proven track record of being a green buildings leader, with more than 600,000 square feet of Passive House buildings currently under construction or in the development process. The knowledge and best practices generated by the Centre will be applicable, and made available, to other cities pursuing aggressive zero emissions buildings programs. Further, the Centre itself could serve as a model, like New York's Building Energy Exchange, for increasing knowledge and skills in a local building industry—such a model could provide a template for other cities to adopt in the future.

### **Funding Request**

The City of Vancouver is seeking US \$225,000 over three years (US \$75,000 per year). The funding is intended to be used primarily for programming at the Centre, including but not necessarily limited to:

- Production of best practice guidebooks, case studies and other resource materials;
- Hosting peer-to-peer learning events, panels and speakers;
- Organizing tours of exemplary, zero emissions buildings for the public as well as for design and construction professionals and policy makers;
- Showcasing zero emissions buildings, successful design solutions and early leaders in the industry; and
- Staff support for activities such as review of case studies and performance data, barrier identification through dialog with industry, and provide information to practitioners interested in zero emissions buildings.

The outcomes of the funding will be measured through performance indicators such as:

- Number of builders and designers participating in Centre-related activities;
- Utilization of resources generated or shared through the Centre;
- Number of resources and/or events shared among partnering cities;
- Benefit to local builders and designers, as determined through surveys; and
- Overall increase in the number of zero emissions buildings in process and under construction in Vancouver.



## Proposed Project 5. San Francisco EV Charging Infrastructure: Phase II Verified Carbon Standard Methodology - Pilot Projects

**CNCA primary member:**

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**Other participating cities:**

**Core (receiving funding):** San Francisco

**Observing:** New York City, Palo Alto, Portland, Seattle, and Vancouver

**Consultant:**

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**Project Summary:** Building on the success of a 2016 CNCA Innovation Fund grant that partnered with the Electric Vehicle (EV) Charging Carbon Coalition (EVCCC) to develop a Verified Carbon Standard (VCS) methodology, this proposal is for a second year of funding to enable CNCA cities to pioneer EV charging carbon credit prototype projects. The new VCS standard is expected to be operational by 2018, and a second phase grant will enable cities to access the carbon capital markets to accelerate investments in EV charging. As a multi-year award focusing on implementation to prototype and scale up the greenhouse (GHG) reductions which EV charging systems can deliver, this follow up CNCA grant would be matched more than 1:1 by private sector contributions from other EVCCC partners to secure the total program funding.

**Problem Statement/Description:** This project addresses the problem that no profitable business model has yet emerged to scale up installation of EV charging infrastructure. EVs must mainstream far more rapidly – propelled by accelerated, profitable installation of EV charging infrastructure – for cities to achieve their transportation and energy sector GHG reduction goals.

**Proposed Solution:** EVCCC’s proposed VCS methodology seeks to open access to carbon capital to strengthen the EV charging systems business case, given the 5-10% return on capital, which the carbon credit revenues can provide. Analysis resulting from the 2016 EVCCC White Paper and further EVCCC partner reviews has confirmed these returns on capital contributions from the EVCCC original carbon business case. Combined with other capital/revenue sources, these carbon contributions therefore create the potential “tipping point” from which other market forces can snowball and restructure transportation systems towards a lower-carbon EV future. To scale up EV charging, it is essential that these EVCCC prototype projects be launched and successfully bring the new EV charger’ carbon capital access to full fruition: venture capital (VC) experts from MIT have confirmed that securing access to such “patient” capital is essential if cleantech investments, like EV charging networks, are to secure access to other VC sources given the strong competition from medical and IT competitors.

Based upon our work to date with CNCA and other EVCCC partners, the updated proposed EVCCC VCS methodology itself now also incorporates several additional project sectors within its scope – including e-bus and e-truck charging and higher power chargers needed to support the longer range 200-300 mile EV’s -- which will help to accelerate this restructuring and expand this program’s “scale-up” potential. The State of Washington has also already expressed interest in incorporating this new VCS EV charging methodology into its capped Clean Air Rule compliance market, which would similarly increase these financial returns given the higher carbon trading prices found in such cap and trade markets.

**Project Impacts:** The GHG benefits arising from this program’s EV charging-based carbon reductions are significant. EVCCC partners’ projects could generate an estimated 0.5m tons CO2 reductions. Based on current US charging system deployment and conservative C2ES utilization and kWh/charging event figures, US EV charging reductions are estimated at 1.8m tons CO2. At leading EV charging network utilization rates, this rises to 6m tons CO2. These figures do not consider the introduction of the increase in longer-range 200-300 mile EV models facilitated by the



new higher power 150/300kW DCFC systems. EIA<sup>6</sup> market share analyses over time indicate that, once tipping points in a country's EV marketplace are reached, penetration rates can rapidly increase by about 20 times within 3-5 years – placing the EV charging GHG reduction potential towards 120-180m tons. (i.e., when EV's would comprise around 2-4% of light duty vehicles on the road compared to 0.1-0.2% now -- and 15% of sales up from 0.7% now) At this level, EV charging projects could contribute 12-18m tons CO<sub>2</sub> credits annually, closer to a representative share for the transportation sector of the total US voluntary carbon market's annual 40m tons CO<sub>2</sub>. The voluntary carbon markets alone – which the EVCCC methodology and partner prototype projects unlock -- therefore introduce the potential scale of capital needed to accelerate EV charging system investments on a transformative scale, whilst the interest already secured from carbon compliance markets further strengthens the kind of capital contributions which can be made because of the CNCA EVCCC successful prototype project demonstrations.

Once the VCS EV charging methodology is accepted in late 2017 (based on CNCA grant #1), this second phase of CNCA funding in partnership with the EVCCC will enable cities and other entities that install EV chargers to secure carbon capital revenues from their certified issued credits. The project will:

1. Establish simple submittal forms for cities to document that their EV charging installations meet the specifications of the VCS methodology – tools which can be used going forward by all cities.
2. Provide technical assistance to cities to submit their project VCS documentation, secure certification.
3. Bundle participating cities' EV installations into a single VCS "group" project, collaboratively across CNCA cities, whose issued credits would be sold into the VCS marketplace. Other cities could subsequently "opt in" to join this grouped project to efficiently issue their credits.
4. Deliver resulting carbon finance revenue to cities to demonstrate successful project prototyping.
5. Position cities to serve in aggregator roles so that other regional partners' EV charging systems (via transit, utilities etc.) can also earn credits through the CNCA VCS project (accelerating scale-up).
6. Collaborate with leading states to examine how EV charging credits can be integrated into their GHG policy and carbon trading systems such as the Low Carbon Fuel Standard to expand EV charging carbon capital access to further compliance markets (such as WA's CAR).
- 7.

CNCA cities' successful prototyping of the first city-lead EV charging carbon projects can create the foundations from which access to these carbon capital markets for EV charging can be mainstreamed and scaled as other cities follow their lead. By the end of 2018, CNCA cities will therefore be able to secure the kind of additional return on capital that carbon markets can provide in order to strengthen the business case foundations (not only for their own investments, but also opening similar doors for other cities and their local private sector partners to replicate) to advance investment in EV charging systems – and scale up the kind of significant GHG reductions that the transformation that EV's can deliver in the transportation sector.

The deployment of CNCA cities' EV charging pilot projects will demonstrate that such carbon revenues can be realized and build the capacity and tools to enable other cities to take advantage of this new layer of value to expand their region's investments in EV charging. For example, the project will establish multiple-choice-style application materials through which CNCA and other cities' carbon credit projects can be certified using the new VCS methodology. This will enable their credits to be sold into the market in an efficient and easy-to-implement manner. The CNCA cities' projects will demonstrate the leadership role that cities can play in not only earning credits for the EV charging systems they own but also serving in an aggregator role to help regional partners like transit agencies, utilities or other private sector partners to join them under the same "grouped" project umbrella that the city pilot projects will be developing. CNCA cities will thus extend their impact to regional partners whose EV charging leadership across their regions is essential to reach the scale needed to achieve the transport-based GHG reductions.

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<sup>6</sup> EIA Global EV Outlook: [https://www.iea.org/publications/freepublications/publication/Global\\_EV\\_Outlook\\_2016.pdf](https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf)



## Proposed Project 6. San Francisco Climate Action through Waste Prevention

### The Power of Packaging Waste Prevention to Help Achieve Climate Action Goals

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2. Project Partners:

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- Clean Water Fund. Samantha Sommer, Waste Prevention Program Manager. 350 Frank H. Ogawa Plaza Oakland, CA 94612, ssommer@cleanwater.org, (415) 369-9160

3. Other potential city participants: Seattle, WA; Vancouver, BC; Portland, OR; Minneapolis, MN.; Boston, MA; Providence, RI; Toronto, ON; Boulder, CO; Washington, DC

4. Project Description:

**Project Summary.** This project seeks to build on the existing GHG emissions models that incorporate changes in consumption practices. The EPA WARM Model can estimate emissions reductions associated with per ton increases in recycling and landfill diversion based upon broad materials types categories. Clean Water Fund's *ReThink Disposable* program has developed a GHG emissions reductions calculator that can quantify reductions associated with the reduction of specific single-use disposable packaging products, but it is unable to compare those impacts to the switch to reusable products or alternative packaging types. When pursuing zero waste goals, cities often lack quantifiable GHG emission reduction measures for policy efficacy. The project team is seeking to fill in the gaps of existing GHG calculators to develop a useable prototype so that cities can incorporate climate data into their Zero Waste plans or policy rationale. Then the project will use the prototype calculator to model the potential GHG reduction impacts of policies that partner cities have already adopted and would provide a model for evaluating future policies cities are considering pursuing. This should spur greater policy innovation and commitment to waste prevention actions at the community level.

**Problem Statement.** Currently, the climate impacts of the increasing "throw away culture" are not being considered in a quantifiable manner. In cities, consumption of single use packaging for food service ware, retail carryout bags, shipping products, for delivered meals, and home-cooking delivery programs, is increasing dramatically. The consumption of single use products and packaging is not considered in the climate footprint of U.S. cities. The ability to measure and report the climate footprint of single use packaging consumption would help bolster support for measures that reduce the use of these products. Cities can benefit from clear guidance on how to measure the climate emissions impact of policies that target waste prevention and phasing out of single-use disposable packaging. There is currently no process to assess the emissions reductions from city efforts to reduce and prevent single use plastic waste, such as banning plastic bags, polystyrene foam food ware and straws, requiring reusables for dine-in, and implementing disposable product charges —and comparing them to packaging transition or substitution efforts, such as banning polystyrene foam foodware and mandating the use of compostable or recyclable products. The utility of existing Zero Waste policies or programs is often measured by the diversion of recyclable and compostable resources from landfill, and valued through extending landfill life, reducing landfill tipping fees, creating jobs, reducing pollution and conserving resources but without a specific GHG impact. Studies point to what is currently known regarding the opportunity for emissions cuts through targeted action to prevent waste generation and reducing some forms of consumption.<sup>7</sup>

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<sup>7</sup> Stolaroff, Joshua. "Products, Packaging and US Greenhouse Gas Emissions." September 2009. AND Clean Water Fund. "Literature Review & Inventory: Greenhouse Gas Impacts of Disposable vs Reusable Foodservice Products." January 2017.



*Problem Description.* This project seeks to further understand and fill the knowledge gap connected to how changing producer or consumer behavior to reduce single use disposables impacts city greenhouse gas emissions. Currently there is no analysis of how waste prevention efforts lead to overall emissions reductions, even when emissions are viewed as consumption-based, rather than production-based. Evaluating packaging policies GHG impacts will require cities to look at consumption-based emissions to assess how local action can avoid and/or reduce emissions in an interconnected global economy that brings products to local markets.

*Proposed Solution.* Including carbon emissions as a layer of analysis will create a more compelling narrative for packaging regulation and align a broader set of stakeholders around proven policy solutions. Current modeling tools would be enhanced and tested on existing zero waste policies that have been implemented or are being considered by cities. This will include assessing potential impacts when cities ban or limit the sale of particular products or material types (e.g. plastic bag and polystyrene bans) and/or prioritize transition to reusable alternatives or recyclable or compostable material.

*Project Impacts.* The intent is to fold this research and final analysis rubric into the global Plastic Pollution Toolkit to provide this necessary context for action, which will be provided to CNCA and disseminated through an interactive website and presented at national and international conferences focused on reducing the global flow of waste into our communities and oceans.

*Stage of Development.* The best analogy for this project is as a prototype. It is attempting to build a new analytical tool for cities to utilize in evaluating the potential impact and effectiveness of their policies. The concept exists and is partially reflected in the EPA WARM Model and the current tool that Clean Water Fund has developed. We're seeking to apply those principles and potential assumptions to the task of evaluation city specific policy efforts. Research is currently being done with existing and potential city partners to better understand this as a leverage point. The USDN has taken on efforts in their Sustainable Consumption project to evaluate aspects of waste reductions using other metrics (economic prosperity, social equity and environmental health), but GHG emissions have not been applied to evaluate packaging regulations. They have used existing modeling to look at CO<sub>2</sub>e avoidance through some product reuse.

*Innovation Hypothesis.* We are seeking to impact two primary markets: single use food service packaging and single use retail carryout bags. These two realms that rely the most on single-use disposable packaging that cities have been targeting policy efforts on. Market barriers primarily focus on how cheap the packaging material is, and its ability to allow more goods to get to more markets due to the low weight of transit, flexibility and durability. Innovation will focus on the hierarchy of 1) eliminate problem packaging, 2) reduce packaging to absolute minimum, 3) redesign packaging to ensure supply chain value of materials that are used, reduction of GHG emissions and support of zero waste or waste reduction goals.

*Scaling/Replicability.* The initial effort will be to review the most common packaging policies that shift away from single use disposables, especially non-compostable and fossil fuel derived plastics, through elimination or shift to widely recyclable or compostable materials. The application of the GHG emissions calculator will review the impacts from current waste prevention and source reduction and potential future policies including product bans, consumer charges, industry packaging fees and other existing and potential efforts by participating cities. CNCA and other cities will have access to the calculator and other packaging reduction tools, such as the Plastic Pollution Toolkit, that will give them a GHG reduction criteria and data that they can use to evaluate, implement and track effectiveness of packaging reduction policies.



## Proposed Project 7. San Francisco San Francisco EV and New Mobility Service Sectors - Workforce Education

### CNCA Innovation Fund Pitch Proposal: Sectoral Market Analyses

#### Electric Vehicles and New Mobility Service Sectors - Workforce Education and Training Needs

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**Other Participating Cities:** New York City, Seattle (Core); Observing (TBD)

**Project Summary:** This project seeks to identify equitable workforce training, curriculum and job placement needs to support new urban mobility industries such as electric, shared and autonomous vehicles (AVs). It will articulate the specific tools, strategies and actions that cities can take to create a just workforce pipeline that provides residents the opportunity to enter careers in these emerging sectors. This project will help cities pursue their greenhouse gas (GHG) reduction goals more swiftly by crafting a road map for cultivating a well-suited workforce. The transportation and energy sectors are rapidly transforming as climate policy and technological advances are accelerating the development and adoption of electric, shared and AVs. These changes will affect not just how we move people and goods, but also the jobs needed to support these systems in the near-to-medium term, and the employment prospects for entire cross-sections of urban populations in the longer term. There is a need to develop technical training to educate and train a new generation of professionals and to provide up skill training to the existing workforce to ensure the transition to electric, shared and AVs does not create workforce displacement. This project will characterize this temporal arc of electric, shared and AV workforce dynamics, before focusing on the near-term workforce development needs and economic impacts of the light-duty passenger electric vehicle (EV) and shared mobility sectors.

**Problem Statement:** There is a significant knowledge gap regarding what the emerging EV and shared mobility sectors mean to workforce development needs and potential impacts. As EVs proliferate and shared mobility and AVs become more mainstream, employment opportunities are expected to grow in all the major sectors of the automobile, high tech, and energy industries; although the numbers employed as entrepreneurial drivers for mobility service providers (including taxis and transportation network companies) could decline. There is updated data on EV fleets, such as the type of jobs and pay associated with them and service rates, but no one has synthesized that knowledge into one study. The shared mobility sector is nascent, and there has yet to be a comprehensive model examining its workforce and economic impacts. Research efforts must account for the current state of the market, policy drivers, and technological advancements accelerating the demand for EVs and shared mobility. This information will allow cities to better work with stakeholders to prepare a trained workforce. Without understanding what the scope and scale of the workforce need is, and without the appropriate workforce to support them, consumers may feel that urban systems are not set up to support a transition from the internal combustion engine (ICE).

**Problem Description:** San Francisco, New York City, and Seattle are leading cities in the adoption of energy efficient technologies, with EVs and shared mobility being among the fastest growing segments. However, employers still indicate having difficulties finding qualified workers. An aging local workforce is exacerbating this situation. In fact, all employment sectors are under pressure for trained and skilled workers as thousands of baby



boomers leave the workplace.<sup>8</sup> This project will look at mechanisms for mitigating the effects of job displacement from a transition to EVs, shared mobility and AVs. To date, however, there is not a comprehensive reference that provides the specific tools, strategies and actions for proactive cities to implement to ensure a just transition. There is disparate information about what workforce development and training currently exists to support the EV sector, but it is not available as a centralized resource. There are many questions that need to be answered, including, but not limited to: What will the labor impact look like for EVs, shared vehicles and AVs? What job sectors will be affected? Who could face a reduction in or elimination of work? What is the need for up skill training versus training new workers? How can cities prepare and train the labor workforce for that impact? How can cities connect underserved populations to critical skills needed to successfully help them train and obtain jobs? How can cities facilitate job placement by establishing job pipelines for trainees?

**Proposed Solution:** The project team has identified workforce development as a critical component of EV and shared mobility market transformation and is invested in benefiting local communities by developing relevant and equitable workforce opportunities. Workers must have the skills necessary to support a successful transition from ICE vehicles to EVs and shared mobility. A network of trained workers will lead to deeper market penetration by establishing consumer confidence in the underlying services that support these sectors. The project's goal is to create meaningful employment pathways for workers, both new and up skill training. The team will collaborate with community partners, including academic institutions, community-based organizations, and industry employers. We must first understand the pipeline of employment opportunities presented by this industrial transformation, and the ecosystem of training needs which will allow cities to build out existing and new workforce development programs. This project will identify workforce training needs for EVs and develop a sectoral market analysis for shared vehicles, which will offer cities the guidance and resources to aid them in creating workforce opportunities that prepare residents for the changing job market. The project team will assess the impact of EV market penetration on the labor market, and build an econometric model that is flexible and scalable to fit the needs of various jurisdictions and geographies to estimate the penetration of shared mobility services. It will compile information on the various sectors involved in providing support for growing and contracting transportation markets such as manufacturing, services, and trades. This data is needed to build a predictive labor demand model, or a multi-sector labor model, to quantify the economic impact and to help develop workforce development strategies to meet changing market needs.

**Project Impacts:** The potential of vehicle electrification in moving cities to their 80 x 50 goals is significant. Transportation represents 27% of New York City's GHG footprint, 67% in Seattle and 46% in San Francisco. Each city is working towards audacious renewable energy goals, which in turn will benefit GHGs associated with transportation to the extent that increasing amounts of vehicle mileage shift to electric versus internal combustion. What is truly transformational about this project is the goal of developing a replicable baseline for a pathway of workforce development during the early stages of the EV and new mobility industries development. This will counteract the inevitable boom in demand for industry professionals in an economic and socially just manner. Having one piece of effective literature for local governments to use in creating workforce development programs will lead to a synchronous network of qualified job candidates and eliminate the need to reinvent the wheel by creating a robust workforce that can keep pace with industry demand.

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<sup>8</sup> <https://www.bls.gov/opub/btn/volume-3/americans-aging-autos.htm> and <https://www.bls.gov/ooh/installation-maintenance-and-repair/automotive-service-technicians-and-mechanics.htm>





## Proposed Project 8. Sydney Urban Planning for Energy Emissions and Comfort

### **CNCA primary member**

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### **Consultant / partner**

Ché Wall, Flux (mini-grant component)

### **Other participating cities**

Core City of Adelaide, South Australia  
Non-core City of Parramatta, New South Wales  
Planning Institute of Australia

### **Project concept and main objectives**

To develop tools to address failure points in embedding sustainability across all aspects of the development planning and approvals framework, including:

- Concise and planner-focused skills development covering technical competency in designing for carbon outcomes, negotiation and advocacy skills and best practice policy development.
- A guidance tool that defines good urban planning policy for greenhouse gas abatement and energy efficiency, informed by sound metrics and benchmarks and with robust checks along the development assessment, approval and physical building phases.
- A succinct web-tool that enables any city with urban planning and development approval responsibilities to test its existing development policies and controls and arrive at a score for GHG emissions and energy planning preparedness.

Supported by CNCA mini grant funding, the City of Sydney engaged the company Flux to conduct research and interviews to develop this application. The mini-grant work covers:

- On-line research to establish international best practice for carbon abatement via development assessment, controls and approvals process.
- Phone interviews with four Australian capital cities plus four CNCA city planning managers/ advisors regarding capacity and capability issues for planning policy, controls and other mechanisms concerning building design and approvals in effecting energy efficiency and greenhouse gas emissions control.
- Summary report describing findings from interviews, key trends, needs, recommended method/format of skills development, planning guideline, glossary of international equivalencies, and web-tool aspects of the project.

A well-designed online tool could be of real value to cities. The tool would ask high level questions upfront that would enable differentiation in subsequent analysis within the tool – reflecting that different cities will come at this with different contexts (e.g. different carbon intensities of grid supplied electricity, different local climatic conditions, different degrees of control/approval on major developments proposed in their cities).

To the extent that cities access and apply the project outputs, this proposal can deliver a faster response to the pressing issues it seeks to address. To date, few cities are close to establishing eco-districts with legislated planning controls giving robust deep reach that influence, materially, a whole city's carbon abatement and energy efficiency outcomes for the better.



## Proposed Project 9. Sydney Net-Zero Heroes

### **CNCA primary member**

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### **Consultant / partner**

Patrick Crittenden, Sustainable Business (mini-grant component)

### **Other participating cities**

CoreCity of Sydney

City of Adelaide

City of Melbourne

Non-core

City of Perth (observing, non-CNCA member).

ClimateWorks, Sustainability Victoria, Green Building Council of Australia, National Built Environment Rating System (NABERS), Climate Institute, NSW State Government, C40.

### **Project concept and main objectives**

Three Carbon Neutral Cities Alliance cities in Australia are currently developing separate communications strategies for engaging residential and business communities to stretch for net-zero emissions. As a developed country, each city is committed to achieving carbon neutrality well in advance of 2050, and demonstrating that we can bend the curve on emissions reductions trajectories.

The absence of a coordinated approach to messaging, data capture and calls to action creates the risk of channel noise and fragmentation from misaligned programs across geographic regions that confuse audiences and limits transformative change.

This project will enable market transformation by mobilizing business and residential communities consistently and at scale. To be impactful, the message and call to action will need to be simple, actionable and benefits driven. To be robust it will need well-understood underpinning principles.

Supported by CNCA mini grant funding, the City of Sydney brought together 25 representatives from cities, state government, national peak bodies and internationally recognized researchers interested in this area to further define the points of high value collaboration.

It identified that considerable research and message testing had been done by some partners that gave a robust underpinning of value to other parties just embarking on their program design.

The group noted that individual engagement campaigns will necessarily be different; driven by segmented messages, regional flavors and political aspirations. However, it also identified the need for common threads; a positive, future-facing narrative; a solid basis in social research; well-developed program logic and theory of change; common definitions; performance indicators and campaign evaluation.

The parties identified the need for leaders to be pushed harder and faster, but also the very real need to connect with new audiences using the latest in behavior change theory to develop value propositions that really resonate. Collaboration will also enable campaigns to be compared and aggregated and will assist the message to be simplified and amplified.

The aim of this program is to:

- Establish a community of practice for knowledge sharing with regular catch-ups.



- Learn from other emerging international best practice.
- Provide some secretariat support to collate documents and relevant insights.
- Create a handbook that could be of value to other countries / jurisdictions looking to establish similar programs.
- Create a shared measurement and evaluation framework.
- Contribute to shared ongoing social research and feedback loops that enable the comparison of campaign participants versus the general population (as control group).
- Identify core performance indicators, define them in a data dictionary, capture and share.
- Aggregate results annually via a common platform and promote to policy makers and community.
- Consider possible community and corporate partnerships that have national application and can help, respectively, increase campaign reach and decrease the cost of participating (e.g. aggregating demand and accessing lower cost renewable power solutions).

In developing and delivering this campaign a handbook would be created with the following indicative table of contents:

- Definitions.
- Common ground statement.
- Program logic and theory of change.
- Personas / segmentation (high level).
- Program messaging hierarchy.
- Common understanding of overarching program, versus campaigns and tactics.
- Taxonomy.
- Net zero, carbon neutral, 100% renewable.
- Scopes and verifying entity.
- Key performance indicators.
- Top shared metrics and definitions.
- Data management, verification, analysis and report back.
- Principles of a shared monitoring and evaluation framework.
- Campaign case studies and lessons learned.



## Proposed Project 10. New York City Thermal Decarbonization Initiative

|                     |   |
|---------------------|---|
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| <b>Consultant:</b>  | Neil Veilleux, Vice President<br>Meister Consultants Group<br>1 Center Plaza, Suite 320, Boston MA, 02108   617.849.9947   <a href="mailto:neil.veilleux@mc-group.com">neil.veilleux@mc-group.com</a>   |
| <b>Core cities:</b> | New York City, NY (lead); Boulder, CO; Washington D.C.; Burlington, VT (“Project Team”)   |
| <b>Observers:</b>   | Boston, MA; San Francisco, CA; Seattle, WA  |

**Project Summary:** New York City, Boulder, Washington D.C., and Burlington (the “Project Team”) seek CNCA Innovation Fund support to fund the second phase of the Thermal Decarbonization Initiative for Cities for local supply chain development and contractor training. This is part of a multi-year effort to scale up the market for cold-climate electric air source heat pumps (ASHPs)—a critical component of each city’s climate goals.

**Project Description:** The Project Team seeks to overcome barriers to ASHP deployment by addressing both the demand and supply side of the market and reducing soft costs with a strategy modeled after the US Department of Energy’s (DOE) SunShot Initiative for Soft Costs. In the near term (1-2 years), the Project Team seeks to partner with ASHP manufacturers and key stakeholders to address three near-term market barriers:

- (1) Low customer awareness of and demand for ASHP technologies,
- (2) Inadequate local contractors and supply chains to provide high-quality installations of ASHPs, and
- (3) High upfront costs for installations.

To address these market challenges—and lay the groundwork for wider scale deployment—in the near term the Project Team seeks to increase the demand for ASHPs in the next 1-2 years by piloting consumer marketing, outreach, and assistance programs while also increasing the availability and quality of local supply chains, in part through contractor engagement and training.<sup>9</sup> The Project Team will continue to build partnerships to leverage resources from state agencies, utilities, energy efficiency program administrators, and manufacturers. More information on these initiatives and anticipated benefits is included in the chart below.

The next phase of the Initiative builds on the following two efforts:<sup>10</sup>

- **Going to Scale: City-Industry Cooperation for Renewable Heating and Cooling** (Sept. 2016): The project team began engagement with ASHP manufacturers with a Rockefeller Brothers Fund-supported workshop on city-industry collaboration to accelerate ASHP deployment. Manufacturers offered immediate support for contractor training and additional support if city-led initiatives develop sufficient customer demand.
- **Thermal Decarbonization Initiative for Cities** (2017): Based on this engagement with manufacturers, the Project Team initiated the first phase of the Initiative with a market segmentation analysis in an effort supported by the Summit Foundation and USDN. The cities will also develop draft roadmaps for thermal decarbonization and strategic electrification, including longer term policy options, by late 2017.

To date, each city on the Project Team has completed or will soon complete (1) their market segmentation analyses to identify target audiences for near-term ASHP deployment, based on both building and customer

<sup>9</sup> Several recent studies (e.g. Ductless Mini-Split Heat Pump Impact Evaluation in Massachusetts and Rhode Island, interim findings from Vermont Dept. of Public Service) indicate ASHPs have not performed as expected due in part to installation quality and customer behavior.

<sup>10</sup> Boulder was a previous recipient of a CNCA Innovation Fund award to explore thermal decarbonization with San Francisco. Boston (observing) is also engaged in a CNCA Innovation Fund-supported project to complete market segmentation analyses and develop community outreach and purchasing programs for heat pumps.



characteristics that indicate the likelihood for cost-effective ASHP retrofits and/or willingness to invest, and (2) thermal decarbonization roadmaps with potential longer-term policy and program next steps for each city.

The Project Team seeks CNCA IF funding to begin the **second phase of the Thermal Decarbonization Initiative for Cities focusing on strengthening local supply chains and reducing soft costs for ASHP deployment**. Specific tasks of the second phase of the Initiative will include:

1. **Convening local contractors and stakeholders** to identify industry training priorities, partners, and resources. Stakeholders include manufacturers, industry groups, community colleges, and training schools.
2. **Designing and launching contractor training programs and supporting tools**, which includes developing both installation and sales trainings in partnership with manufacturers; creating or expanding opportunities for certifications or qualifications, either city-led or through third parties, to ensure ASHP installation quality; and the development of potential customer-facing sales tools for use by contractors.
3. **Learning network and continued stakeholder engagement** to identify ways to leverage partnerships or existing funding for ASHP deployment and sharing best practices across cities.

The second phase of this Initiative will help create a high-quality supply of service providers to meet the demand from potential customers. Strengthening the supply chain will also reduce soft costs by improving contractor skills, reducing customer acquisition costs, and developing new business models to deliver quality services—which also can generate local economic opportunities and jobs. At the same time, improving the quality of installations will help build demand by ensuring customers have a positive experience.

Over the long term, the Project Team **anticipates this project will become a multi-year, multi-million dollar initiative** to transform the broader RH&C marketplace. Future stages will build on existing efforts to create consumer marketing, outreach, and assistance programs to generate customer demand that, when matched with mature local supply chains, will create a self-sustaining market for ASHPs. There is enormous potential for scalability, given that the Project Team and observers include a diverse set of cities, including some of the largest cities in North America, and there is a commitment from both policymakers and industry leaders to jointly address market challenges. By tailoring approaches to local conditions and comparing lessons learned, other cities will be able to efficiently replicate best practices to achieve true market transformation.

| Near-term Focus Areas for the Thermal Decarbonization Initiative for Cities  | Targeted Stakeholders  | Benefits  | Potential Actions   | Prospective Funders outside of CNCA  |
|--|--|---|---|--|
| <b>1) Demand Generation (partially funded):</b> Build market demand for ASHPs through locally-driven outreach, education, and awareness programs. The market segmentation analysis (funded in the first phase) will develop target audiences; future funding will be required to implement programs. | End users/<br>customers  | Increase market demand for ASHPs;<br>reduce soft costs                          | Outreach and assistance programs;<br>purchasing campaigns;<br>marketing | Foundations; city budgets;<br>manufacturers                                    |
| <b>2) Local Supply Chain Development (seeking CNCA IF funding):</b> Improve quality of installations and broaden the local workforce through contractor engagement, training programs, and contractor sales tools to help ensure increased demand is met with a quality supply of services.          | Local contractors,<br>distributors,<br>and supporting industries | Improve installation quality;<br>reduce soft costs;<br>increase market demand   | Training, certification, and other workforce development programs       | Manufacturers;<br>foundations; state and federal partners;<br>workforce grants |
| <b>3) Stakeholder engagement (partially funded):</b> Develop and sustain thermal decarbonization programs by creating buy-in and potential cost-sharing opportunities through ongoing engagement with manufacturers, state policymakers, utilities, and energy efficiency program implementers.      | Manufacturers;<br>State policy-makers & regulators;<br>utilities | Funding streams;<br>policy support;<br>access to utility programs/<br>resources | Stakeholder working groups;<br>new incentives or financing programs     | State agencies;<br>utilities; efficiency program administrators                |



## Proposed Project 11. New York City High Performance Hub

|                             |  |
|-----------------------------|--|
| <b>Project Title:</b>       | High Performance Hub (working title)             |
| <b>City Lead:</b>           | New York City Mayor’s Office of Sustainability   |
| <b>Consultant Support:</b>  | Building Energy Exchange                         |
| <b>Core Cities:</b>         | New York City, NY; Vancouver, BC; Washington, DC |
| <b>Observing Cities:</b>    | Currently none                                   |
| <b>Pursuing mini-grant:</b> | Yes  |
| <b>Project term:</b>        | Two years (anticipated)                          |

**Impact:** To meet aggressive climate action goals while ensuring resiliency, affordability and comfort, cities must move beyond current codes and simple retrofit measures to higher performance buildings, both new and existing. Currently there are limited resources available for decision makers implementing high performance projects (as opposed to standard measures), and those resources that do exist are dispersed, are often not easily accessible, and are often created by vendors or service firms with financial incentives, and even these are often not aligned with the specific needs of a city or region. The market needs a neutral organization that acts as a trusted advisor to deliver curated knowledge and best practices through advanced training, case studies, and technical briefings while providing important opportunities to convene stakeholders. An objective venue, both physical and virtual, can remove a significant barrier in the process of delivering high performance buildings and ensure that lessons from across North America are communicated broadly and at scale. Every market actor in the building industry will benefit from access to critical resources required to deliver high performance buildings.

**Project Description:** Building on an existing collaboration between New York City and Vancouver (initially funded by CNCA), New York, Vancouver and Washington D.C. seek support to create a scalable education and information network of energy efficiency resources that provides guidance for building owners looking to complete deep, holistic retrofits of their buildings, or build new high performance projects, with materials that are specifically relevant to the challenges and needs of partner CNCA cities. Currently in New York City, the Building Energy Exchange (BE-Ex), an independent nonprofit created by New York City that operates as an objective advisor, has developed a strong track record providing much needed resources to stakeholders across the industry. BE-Ex delivers actionable content at a physical, “storefront” energy efficiency resource center that offers trainings, roundtables and other events for building industry decisions-makers. BE-Ex also produces actionable reports, technical briefings and informative case studies, and hosts interactive exhibits. Vancouver seeks to create its own Center of Excellence, to support recent policies designed to drive high performance buildings, and Washington’s Green Light Grant program has commenced with case studies and technical bulletins that will accelerate technology integration and green building strategies.

With CNCA support, BE-Ex will tailor existing tools, and develop new resources to deliver in Vancouver and Washington DC, and will work with each city to develop an appropriate landing platform for this delivery in each location. In the case of Vancouver delivery will be via the Centre for Excellence, while in Washington DC a robust and existing ecosystem of existing organizations and locations will be utilized to maximize effectiveness. The information and education resources delivered will address a diverse array of building typologies, to ensure relevance across CNCA partner cities, and will focus on those technologies, systems, and procedures fully vetted by industry and proven to significantly reduce GHG emissions. BE-Ex will work with each city to create a physical and virtual storefront, gathering together both new resources provided by BE-Ex but also the significant resources already available in each community. To ensure the successful deployment of resources, partner cities will take an active role in the network by providing staff time to manage and promote the project; identify and help to create landing platforms (places, organizations, etc.) that act as local ‘hosts’; and market the project to develop and engage local actors (real estate professionals, building owners, etc.)



BE-Ex currently develops a strong mix of resources for the building industry. Partner cities will benefit from the following tailored resources:

- **Training & Education:** Topical panel discussions, primers on high performance process and components, and detailed technical courses on the most critical systems or issues (energy modeling, envelope detailing, etc.)
- **Knowledge Sharing:** Stakeholder engagement events, industry roundtables and other forums that educate key players and provide venues for networking
- **Case Studies/Briefings:** Detailed project descriptions with an emphasis on challenges faced; Technical briefing on critical subjects (PH certification, VRF implementation, etc.)
- **Exhibits:** On technologies and systems, designed for any CNCA location
- **Guidance Packages:** Full suites of retrofit solutions tailored to specific building types and organized around asset milestones (anytime/anywhere; refinance; tenant turnover; etc.)

With CNCA support BE-Ex will work with partner cities to both tune existing resources and develop additional resources which target the most critical typologies or systems in each region. With this “target and tune” approach, resources will be applied for maximum effectiveness across multiple regions. As the model matures, additional cities will be in a position to benefit from the library of technical resources developed.

#### **Funding Request**

The project is seeking \$250,000, over two years, to provide:

- Dedicated BE-Ex staff to implement, curate, and manage the resource pipeline;
- Create ‘landing platforms’ in each city, recruit and support local partners in resource dissemination, in a minimum of two partner cities
- Provide technical infrastructure for virtual pipeline and on-site event activities (equipment, web portals, webinar services, live-streaming tech, etc.); and
- Fund marketing and awareness campaign to directly target specific audiences

#### **Contact information**

**City Lead:** John Lee, Deputy Director of Buildings & Energy Efficiency, NYC Mayor’s Office of Sustainability, 253 Broadway, 14<sup>th</sup> Floor, NY, NY 10007; 212.788.1520; [JHLee@cityhall.nyc.gov](mailto:JHLee@cityhall.nyc.gov)

**Consultant:** Richard Yancey, Executive Director, Building Energy Exchange, 31 Chambers St., Ste. 609, NY, NY, 10007; 347.255.6311; [rcy@be-exchange.org](mailto:rcy@be-exchange.org)



## Proposed Project 12. Seattle Human Centered Design & Pilot Testing

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Project Manager: Tracy Morgenstern [tracy.morgenstern@seattle.gov](mailto:tracy.morgenstern@seattle.gov), 206-386-4595  
Consultant: Gensler, Jacob Simons, Director of Design Strategy, [Jacob\\_Simons@gensler.com](mailto:Jacob_Simons@gensler.com)  
1200 6<sup>th</sup> Avenue, Suite 500 Seattle, WA 98101, 206-654-2040  
Core Cities: New York, TBD  
Grant Amount: \$100,000

### **Human Centered Design: Transforming how we approach the challenge of decarbonizing cities**

Problem Statement: Decarbonizing our cities requires transformational solutions which advance a range of community goals. A challenge of this magnitude requires new approaches to generating ideas and designing implementation strategies that work at the whole system scale. Innovation development at an urban scale is a complicated process. Ideas need to move from concepts to prototypes and launch before they are ready to scale in other locations. The most impactful innovations involve multiple stakeholders who need to be engaged at each step of the process. (CNCA Innovation Fund Strategy). Human Centered Design (HCD) offers a proven design methodology which centers the people impacted by the challenge and employs innovative techniques to generate a wider range of creative solutions than typical government processes. While HCD was initially developed to design things, it is increasingly being used by government and civil society to design solutions to social and environmental challenges.

The climate challenge isn't only about getting rid of oil and gas, but designing systems that better meet the needs of our communities. Further, our fossil fuel economy/system has disproportionately benefited white middle and upper income residents and disproportionately burdened people of color and lower income residents, who typically have not had power in government decision making. By using HCD techniques to tap into the collective knowledge of those who live, work, and play within these systems we can unlock innovative and transformative solutions that advance a range of community goals. By using HCD techniques, we can create true collaboration with community, centering people of color and lower income residents, to help ensure actions are whole-systems in scale, achieve deep carbon reductions, meet the needs of the people who make up the system, and are equitable and widely-supported.

#### Proposed Solution:

**Change the way cities approach solving for climate issues by working with teams to cultivate a human-centered design mindset and equipping them with a human-centered design toolset.** An initial two-day immersive training will lay the foundation, and be followed up by ongoing technical assistance to ensure teams are sufficiently empowered to implement new ways of engaging the community, defining climate problems, generating new ideas, and building a coalition for scalable impact. The project will provide training and assistance to three cities to apply the techniques and collect their experience to share out with the broader network.

#### Project deliverables:

- a 2-day training for approximately 3 cities in HSD techniques, including creating a roadmap for applying the techniques to a deep carbon reduction challenge in their city
- technical assistance for each of the three cities in implementing their pilot project
- A template for cities to report out their experience, to be completed by the cities
- Summary of findings and recommendations from the pilots

Human-centered Design is a form of problem solving employed to generate solutions to *wicked challenges*. Wicked challenges are issues that are interconnected to other problems, constantly evolving, largely driven by human values, and where knowledge is incomplete. Human-centered Design is a systematic process aimed at solving problems in which no single piece of data or any level of data disclosure will solve. It is options-focused, possibility driven, and iterative. (<http://www.advancedconservation.org/design-thinking/>)





## Proposed Project 13. Seattle HVAC System Energy Performance

### Project Pitch – CNCA Innovation Fund

Jessica Finn Coven, Director & Chief Resilience Officer, Seattle Office of Sustainability & Environment  
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Consultant: PNNL \$200,000  
Other Participating Cities: New York, Boulder    Observer City: San Francisco, Vancouver

### Whole System COP: Transforming real-world HVAC performance in North America

**Problem.** Buildings represent a significant source of carbon emissions worldwide, and their HVAC systems alone account for more than a third of their energy and carbon impacts. Despite this, North American energy codes do not prioritize high-performing over poorly-performing HVAC systems, thus perpetuating high levels of energy consumption and carbon emissions, and blocking a transition to European-type performance-based codes.

Commercial building energy efficiency depends largely on the performance of three major systems: envelope, lighting, and HVAC. While building envelope thermal values and lighting power densities each have well-established whole-system compliance paths in the North American energy codes, HVAC systems have had no such compliance path other than full-fledged building energy modeling. Instead, standards are separately defined for each type of chiller, boiler, heat pump, fan and cooling tower, so that the energy use of fully code-compliant systems varies widely among similar buildings.

An electric furnace with a coefficient of performance (COP, see definition below) of 1.0 is every bit as code-compliant as a ground-source heat pump with a COP of 3.7. Even high-efficiency equipment can be incorporated into systems that use energy wastefully while remaining code-compliant. Since little preference is shown in our codes for high-performance HVAC systems, there is minimal market pressure to design such systems. Thus VAV/reheat, a relatively wasteful system type, has remained the predominant HVAC system for multistory commercial buildings in North America, whereas highly-efficient system types are most typical in northern Europe. While performance codes based on energy modeling are common in Europe, North American energy codes to date remain fundamentally prescriptive. Given the balky nature of North American code development processes, an abrupt shift in code structure is highly unlikely in the foreseeable future.

**Proposed solution.** Develop model code language (with an associated digital compliance tool) that creates a single minimum efficiency standard for each building's entire HVAC system. Seattle will submit this language as a code change proposal to the 2018 Seattle Energy Code, which typically triggers uptake in the next code cycle at the state level and facilitates adoption of similar codes in other jurisdictions.

The stringency of this proposed standard will be set at a level that disqualifies the least efficient system types, thus requiring engineers to search out technology that most economically meets the overall system efficiency standard. This will spur competition and innovation in efficient HVAC design and reduced reliance on fossil fuels across North America. It also facilitates a future transition to a performance-based or outcome-based code.

A "COP" (coefficient of performance) for a piece of equipment is defined as the ratio of the useful heating and cooling output to the electrical energy input, with higher ratios indicating better performance. Similarly, our proposed "Whole-System COP" (WSCOP) will compare the annual heating, cooling and dehumidification energy *output* for the entire HVAC system to the annual energy *input* required. As the central work of this project, a software tool will be created to determine those annual thermal outputs and energy inputs, based on the proposed equipment efficiencies, controls, airflow and other parameters, under the expected operating conditions. Thus, a Toronto office building using ground-source heat pumps and occupancy-sensing controls might have a WSCOP less than half that of the same building with a traditional VAV/reheat system. This single number



would express the annual HVAC system efficiency for an entire building, and enable comparisons with the cost-effectiveness of other building systems. The energy code would determine a minimum allowable WSCOP for each building type and climate zone, based upon the characteristics of an optimal equipment package. This will effectively prohibit the use of inefficient systems, and will transform how mechanical systems are specified, much as lighting system power code requirements transformed the lighting industry.

**Existing foundational work.** The software tool and model code language will build on existing work:

- A comprehensive set of “primary packages,” baseline HVAC systems used for setting efficiency targets, was created for ASHRAE during development of ASHRAE Standard 90.1 - 2016.
- The Systems Efficiency Initiative, a cooperative venture of 50 industrial, government, and advocacy organizations assembled by the Alliance to Save Energy, published its first report on systems-level efficiency in 2016.
- Pacific Northwest National Laboratory, working with US DOE, is developing a whole-building HVAC metric as part of its Asset Rating Tool, and thus is proposed as the primary consultant.
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**Bridge from prescriptive to performance.** Although a single leap from the current North American prescriptive codes to modeled performance codes is unlikely, the “whole-system COP” concept would familiarize HVAC designers and manufacturers with a performance-based compliance method. This, together with overall system compliance methods already common for lighting and building envelopes, would facilitate the future transition to performance codes. This compliance methodology will be submitted as a code change proposal for inclusion in the 2018 Seattle Energy Code. Once in force, it will serve as a model and proof of concept for other motivated jurisdictions and for the national standards. The Whole-System COP of this proposal provides the most viable intermediate step for a future transition from prescriptive to performance-based codes in North America.

**Legal and code development issues.** Seattle regularly amends the Washington State Energy Code to require higher-performing commercial buildings, as part of its drive towards carbon neutrality, and the Washington State code itself is required by law to achieve a 70 percent reduction in new building energy use by 2031. California, Vermont, British Columbia, New York and a dozen leading North American cities have instituted similar targets. As improvements to the prescriptive code become progressively more challenging, continued progress is likely to require performance-based codes. Such a broad-based performance standard does not dictate any specific equipment efficiencies, and therefore will not conflict with US federal preemption rules. The “primary equipment packages” used in the development of ASHRAE 90.1 were funded by the US Department of Energy and are thus in the public domain.

**Project Development Partners.** The Northwest Energy Efficiency Alliance (NEEA) has made a commitment to actively support this process. Pacific Northwest National Laboratory will be invited to serve as the primary consultant to the project.



## Proposed Project 14. Toronto Collective impact – Resident Mobilization for Behavior Change

### Project Manager:

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**Partners:** Consultant: TBD through bid process; Partner Cities: TBD

**Project Type:** Concept Development

**Project Summary:** Between August 2015 and May 2016 the City of Toronto engaged over 2000 residents in a conversation about a shared low-carbon vision for our city. The second most frequently raised issues (after transportation) was behaviour change. Residents recognize that beyond the technological elements of deep decarbonisation individual behaviour choice is a critical factor in success. While engagement with residents already involved in environmental and climate change issues was significant, we recognized the diversity of racial, geographic, and specifically socio-economic communities was limited. Toronto has already completed a research project with the support of USDN on engagement in planning process that seeks to advance the interests of equity-seeking groups, and will employ these findings going forward. This project seeks to better understand the potential of collective action and social innovation frameworks for mobilizing diverse residents to participate in programming across issues areas in ways that support deep decarbonisation.

### Objectives:

- Explore and evaluate approaches to mapping existing non-governmental groups that are drivers of environmental change (e.g. local “green” groups, city-wide environmental organization, environmental advocacy groups).
- Explore approaches to identify and map existing community groups engaged in social change/social innovation work that have overlapping with objectives with deep decarbonisation (e.g. transit riders groups, community revitalization movements).
- Build capacity across sectors to advance decarbonization in step with community building and social equity goals through resident mobilization.

### Elements:

1. Create system map of: (1) community environmental actors in Toronto using social innovation’s application of complex systems theory and (2) their intersection with sites of influence of non-environmental actors for social change.
2. Analyze available socio-demographic profiles of current participation in available decarbonization programming and establish best-practices for future data collection e.g. (Home energy retrofit loans, Eco-roof incentives, Better Building Partnership).
3. Create system map of programming within the City of Toronto that involves direct resident engagement (e.g. community development offices, parks and recreation programming) that has the potential to include climate change related engagement, and identify best-practices for integrating environmental education and outreach.
4. Develop a workshop focused on deep decarbonization based on Tamarack Institute Community Change Institute (Vancouver, Fall 2017) that is bringing together community change-makers to explore the critical role citizens, organizations and government play in co-creating the future of cities. Deliver workshop in Toronto to understand potential of building citizen and non-governmental collective impact approaches to decarbonization resident mobilization.

**Budget:** \$110,000 (\$30,000 workshop + \$60,000 consulting team for work + \$10,000 cross-sectoral mobilization best practice guide development)

**Timeframe:** 12 months