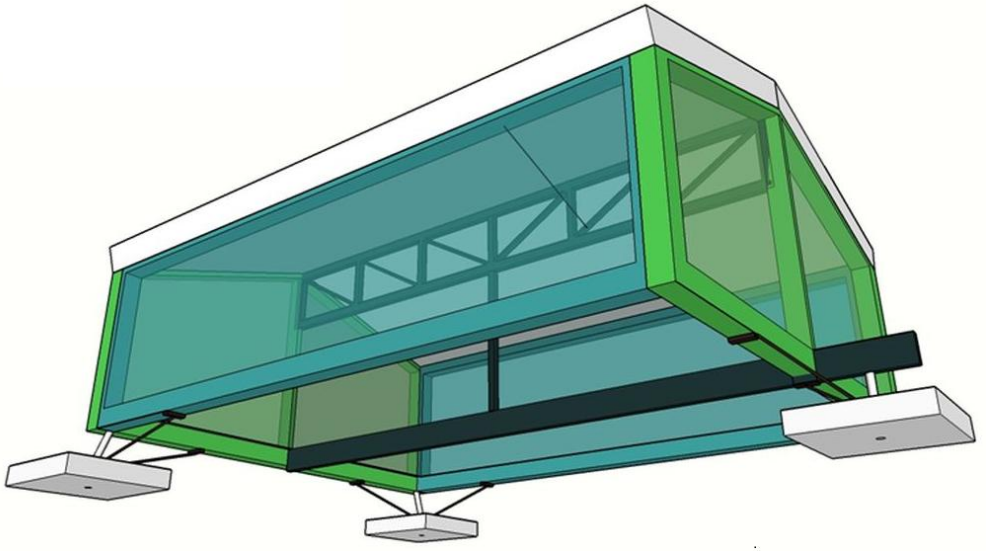


The RESTCo House and Co-operative Supporting Infrastructure

Darryl McMahon
Remote Energy Security Technologies Collaborative (RESTCo)
Northern Lights Conference, February 3, 2018

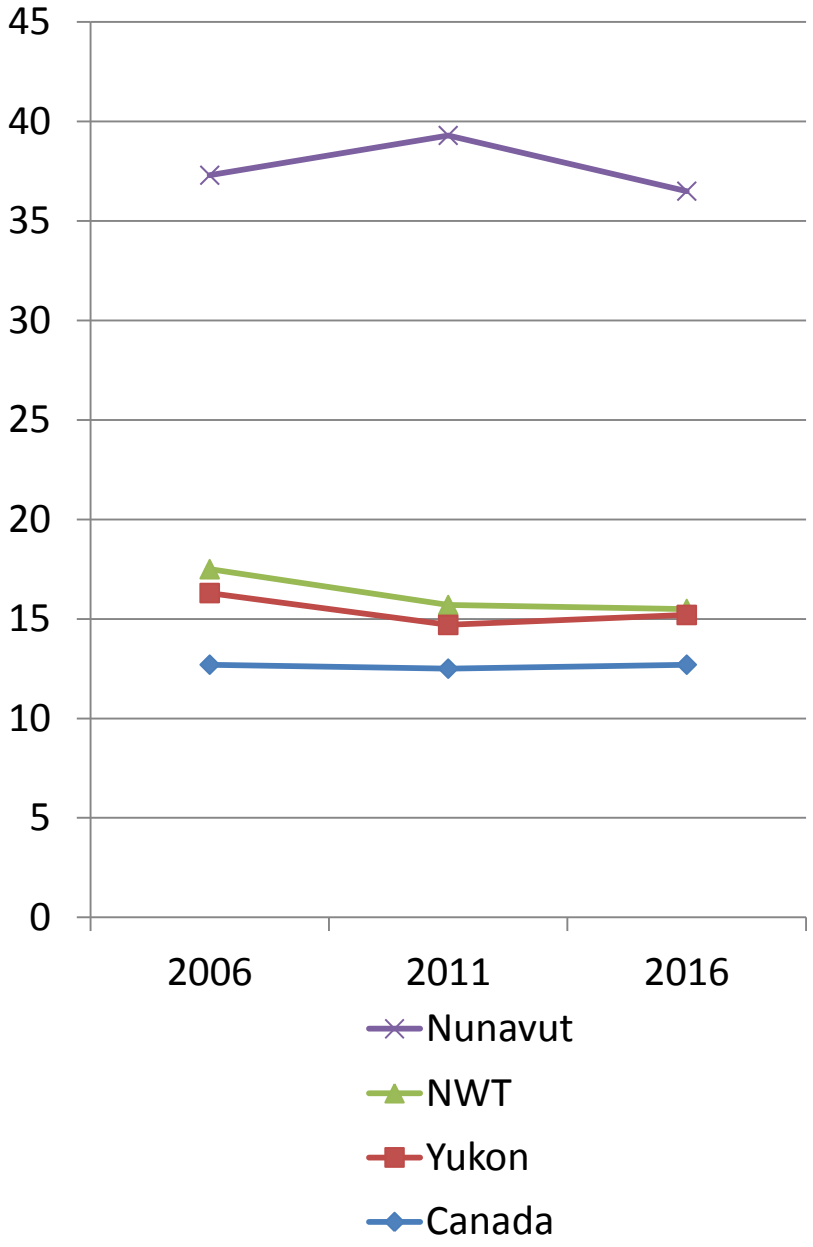
What RESTCo Does

- Independent, Canadian science and engineering research and development
- Collaborative (network)
- Energy security for remote communities
- Reduced emissions energy systems (buildings, infrastructure, transportation, food)
- Innovations in oil spill response (rapid, oil recovery, effective removal, full remediation)

Core Housing Need

CMHC definition:

Core housing need is the indicator to identify households unable to access acceptable housing. (inadequate in condition or size, unaffordable, or just doesn't exist)



Hazmat suits required: 116 Nunavut public housing units need heavy duty mould clean-up

124 units could be addressed by local housing authorities, 116 require outside contractors

By Sara Frizzell, CBC News Posted: May 18, 2017 3:00 AM CT
Last Updated: May 18, 2017 8:50 AM CT

In the past year, the Nunavut Housing Corporation investigated 271 of its public housing units — roughly 5% of its housing stock.

It went into those units based on local housing authorities' recommendations and found that 31 were not a concern, meaning the mould could be cleaned by tenants.

10% of residents in Nunavut community infected with TB, crisis team to visit Qikiqtarjuaq, Nunavut, has the highest tuberculosis infection rate in the territory

CBC News Posted: Dec 29, 2017 4:00 AM CT Last Updated: Dec 29, 2017 10:01 AM CT

With 10 per cent of residents in Qikiqtarjuaq, Nunavut, infected with active or latent tuberculosis, the Government of Nunavut is looking for new ways to combat the disease.

While the community of 600 has the highest rate in the territory, Nunavut's chief medical officer of health says she's also worried about infection rates in 15-17 of the territory's 25 communities.

HIGH NORTH NEWS

29/03/2016

Shoreline erosion in Nunavut, Canada. (Photo: Mike Beauregard)

Coastal Erosion and Thawing Permafrost: A Dangerous Duo

'It scares me': Permafrost thaw in Canadian Arctic sign of global trend

Buildings in Inuvik being demolished because of shaky foundations

By David Michael Lamb, CBC News Posted: Apr 17, 2017 3:00 AM CT
Last Updated: Apr 17, 2017 3:00 AM CT

For years now, buildings in Inuvik have been gradually sinking into the ground as it softens. Others are so unstable, they are literally sliding off their foundations.

The thaw is destroying buildings, forcing construction crews to change their methods. Buildings used to be hoisted on stilts sunk five or six metres into the ground. Nowadays, said McDonald, "they're finding that they have to go down in the 15- or 20-metre range to get a stable enough foundation."

Catastrophic Climate Change

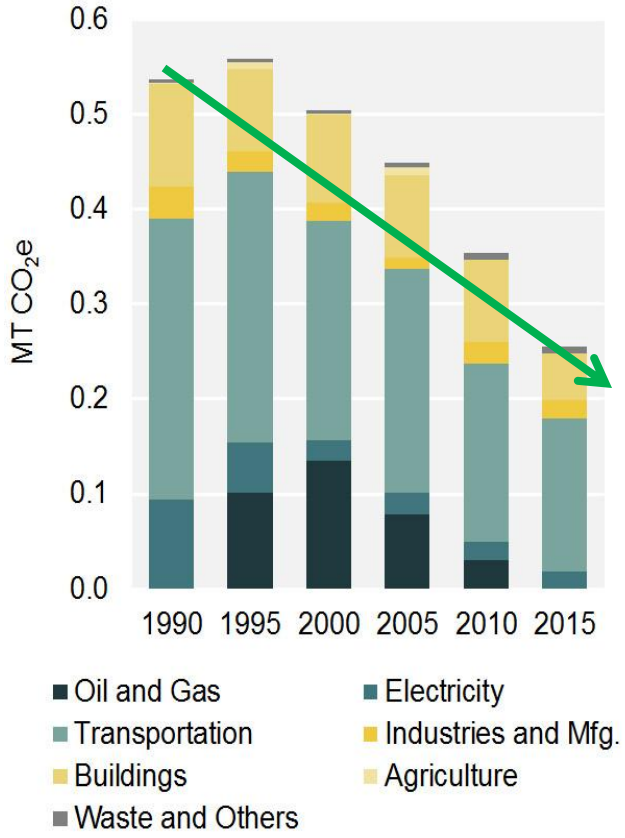
The majority of Canada's Arctic communities are coastal or located on or near permafrost

Coast line erosion is accelerating due to warmer water and atmosphere, rising sea levels, stronger storm systems with higher wind speeds and higher storm surges

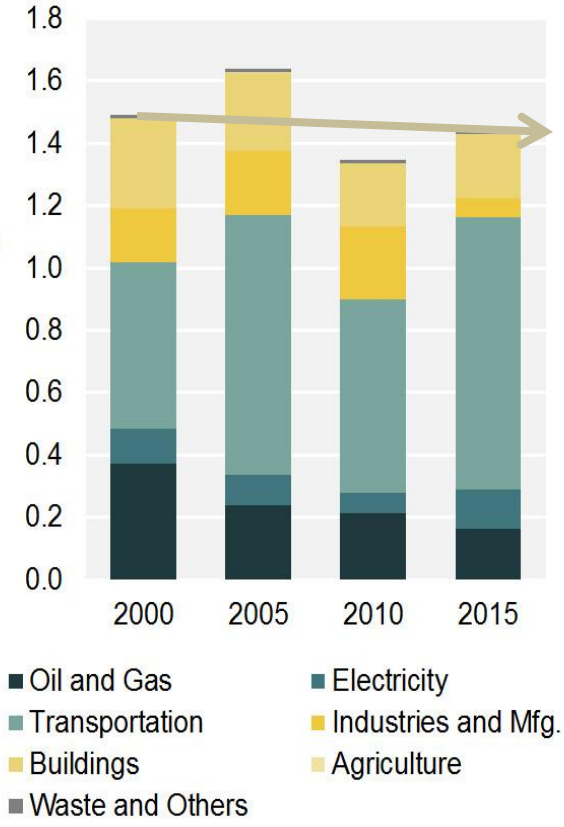
Permafrost is melting, releasing methane, a potent greenhouse gas

The arctic sea ice mass is disappearing at an accelerating rate

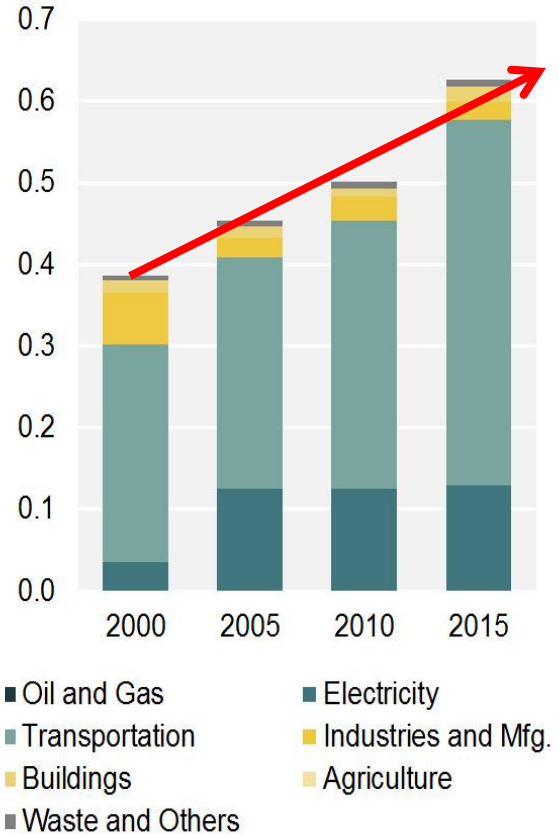
GHG Emissions in Territories



Yukon



NWT



Nunavut

Some northern communities are using more fossil fuels as they grow

Herschel Island YT

Shishmaref AK

Kashechewan First Nation evacuated due to flood concerns

Latest state of emergency comes as new agreement considers moving remote northern Ontario First Nation

By Marina von Stackelberg, CBC News Posted: Apr 17, 2017 11:50 AM ET

Evacuation occurs annually

The town of Kapuskasing has received evacuees from Kashechewan every spring for more than a decade.

Northwest Territories Premier Bob McLeod was right when he issued a "red alert" in November and called for an urgent national debate on the future of the Northwest Territories. His peers, the premiers of Nunavut and the Yukon Territory, would be justified in calling for the same thing.

As housing, poverty and unemployment statistics show, Northerners are at a crossroads in their efforts to find a balance between a traditional way of life that puts country food on the table and one that provides basic goods, luxuries and economic opportunities that most southerners take for granted.

There may be a problem
Is anybody else ready to try a different approach yet?

Housing designed for the North?

Stop. We've heard this all before.

We've Heard This Before

We know we're not the first to recognize the problems and propose a solution

- **Seabird First Nation building a sustainable future**
- **First Nations housing**
- **Best Practices in Sustainable Housing Delivery in Inuit Nunangat**
- **Meeting the northern housing challenge**
- **New Ways of Looking at Housing in the North**
- **Nunavut Ten-Year Inuit Housing Action Plan (2006-2016)**
- **Housing in Nunavik**

And We'll Be Hearing It More

We want to work more with northerners to ensure superior solutions are put in place - fast

- **Arctic House Design Saves Energy and Embraces Inuit Culture**
- **The relationship between house form and culture in northern Canada**
- **First Nation Sustainable Development Standards**
- **New First Nations housing standard better than a building code**
- **Northern Ontario First Nation residents get to design their own homes in pilot project**

There may be a problem

Is anybody ready to try a different approach yet?

Housing designed for the North?

Built to last
Designed to be maintained locally
Energy efficient
Healthy for occupants
Can be built on permafrost
Can be easily re-leveled if ground shifts
Can be moved (floods, erosion)
Interior structure is flexible (no internal load-bearing walls)

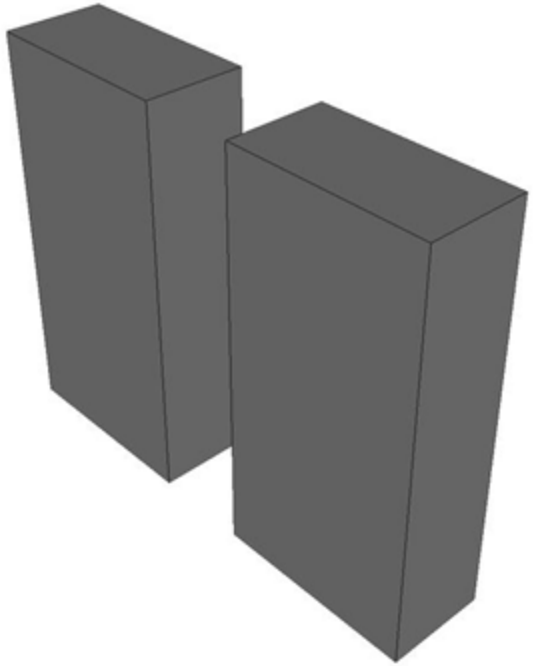
With matching infrastructure?

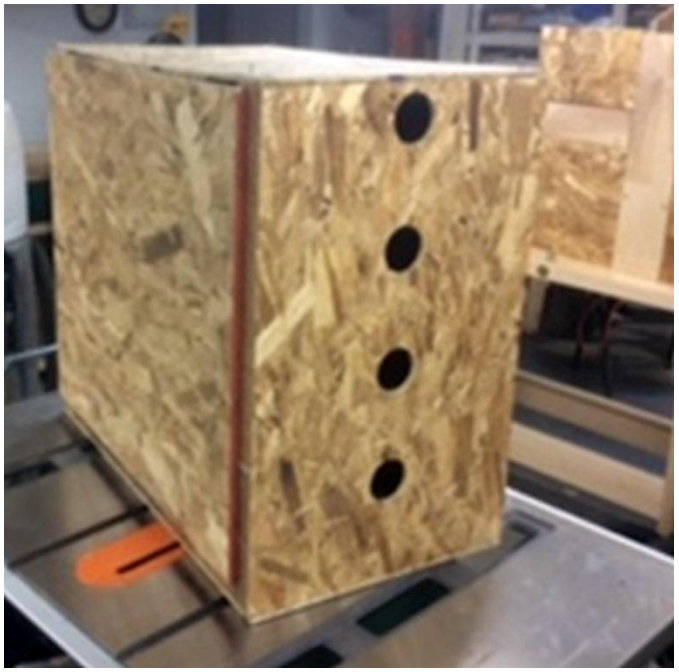
Supported by distributed utilities
External utility module can move

The RESTCo House Proposition

- More housing, faster
- Healthier housing (air changes, humidity)
- Much reduced energy use
- Reduced dependence on diesel (heating oil)
- More local employment and enhanced skills
- Planning for change, including climate change
- Reducing costs through economies of scale and use of local residents

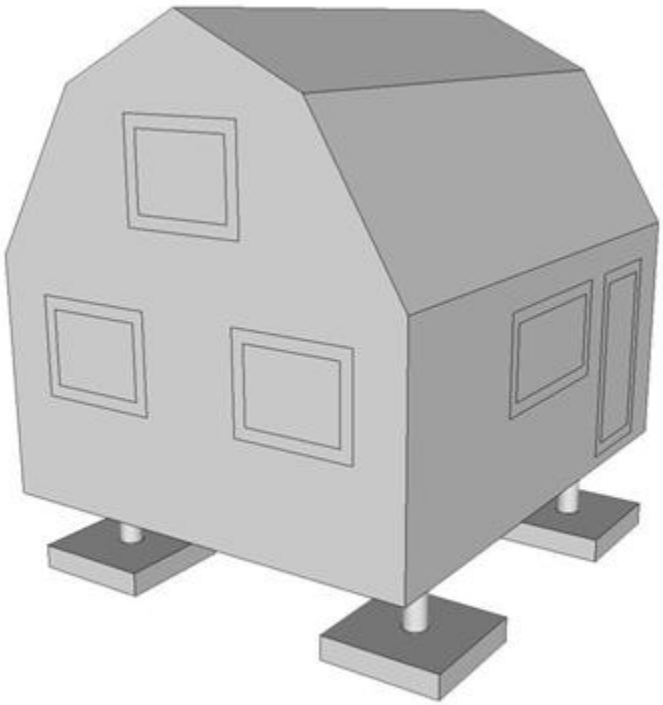
Starting with a Key Building Block

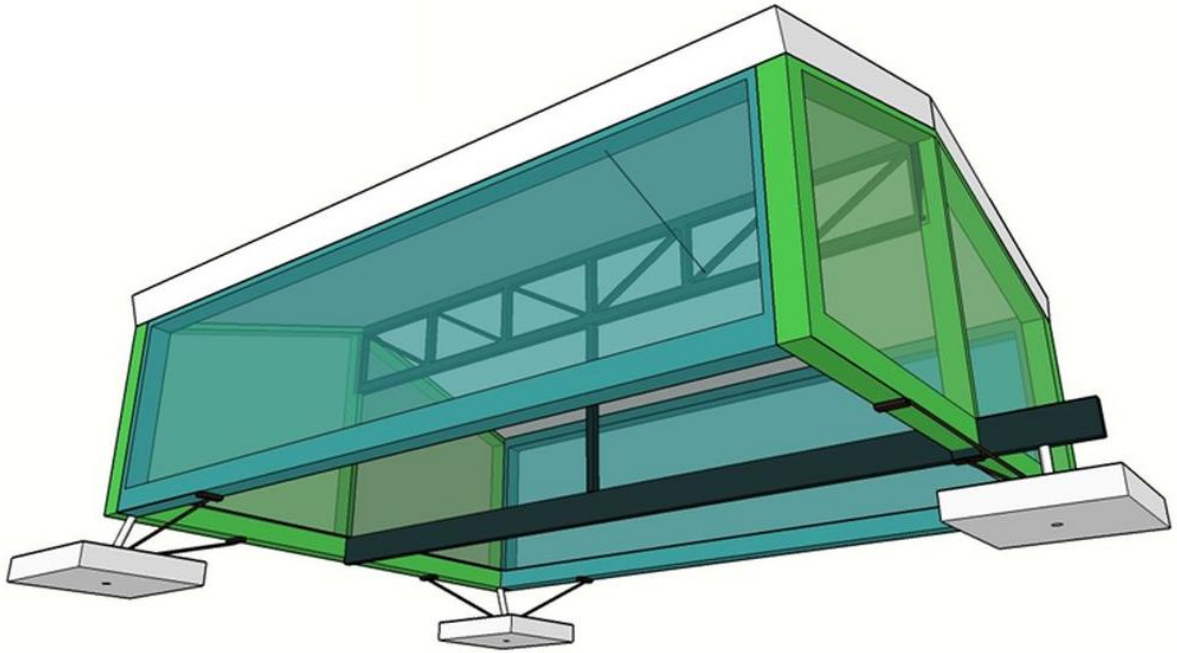




The Structural Insulated Panel (SIP)
Built in the community by residents

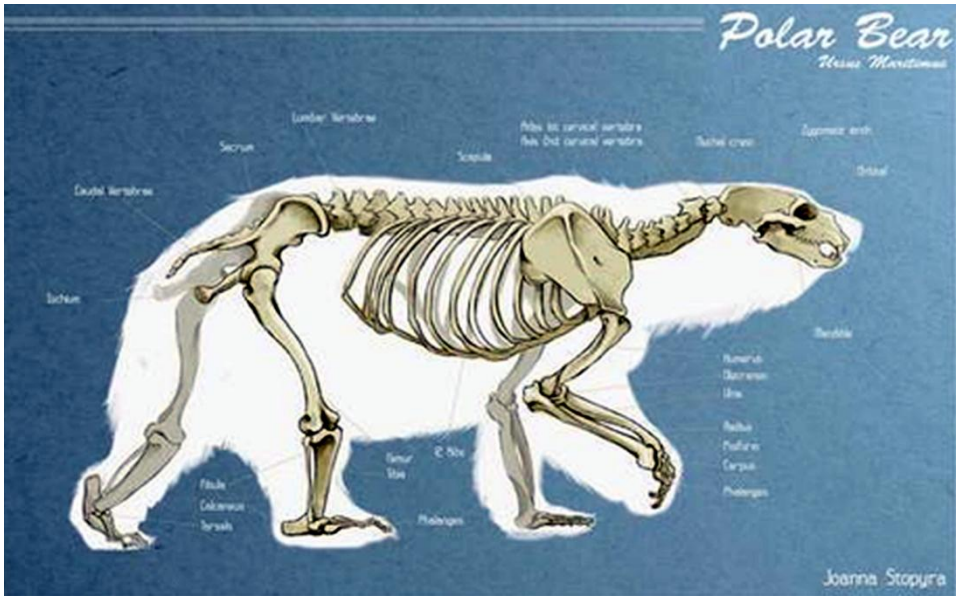
Build a House





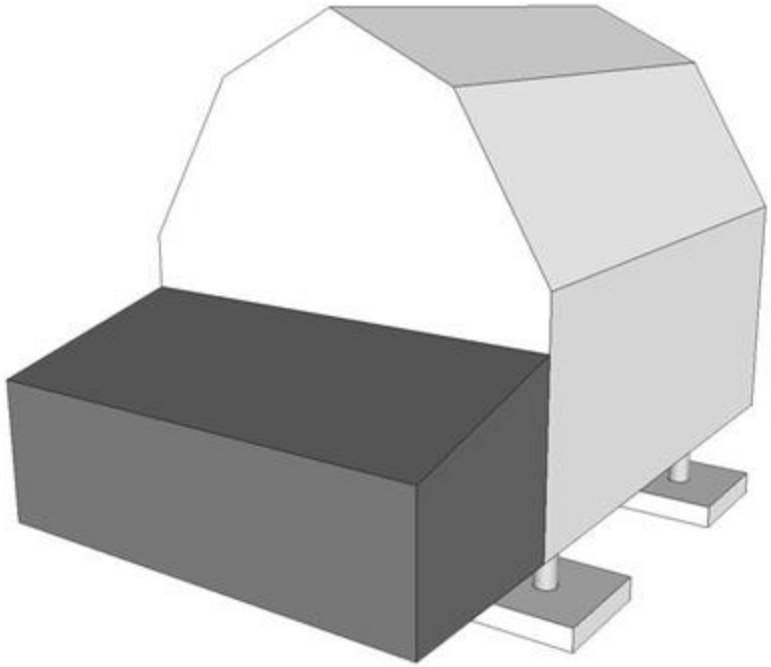
Can sit on permafrost, support points allow for easy adjusting if ground shifts

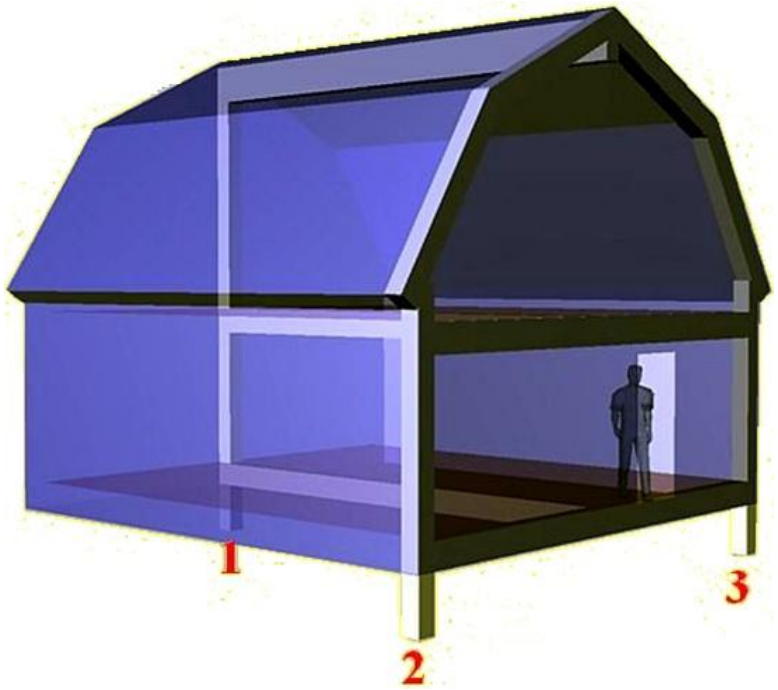
The RESTCo House



- The building sits on 3 or more support points
- If the ground shifts, the house is returned to level using jacks at the support points
- For larger or heavier buildings, additional support points can be added

The RESTCo House

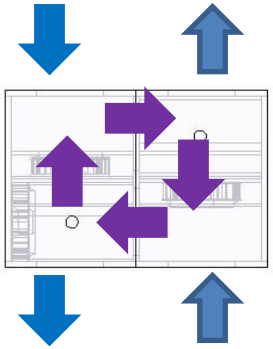




Buildings are configurable – inside and out

No internal load-bearing walls, various sizes/shapes

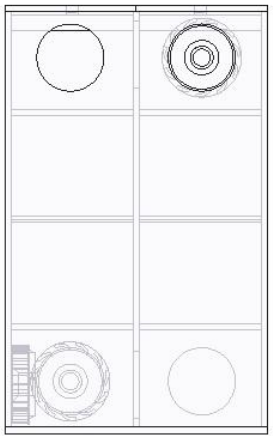
The RESTCo House

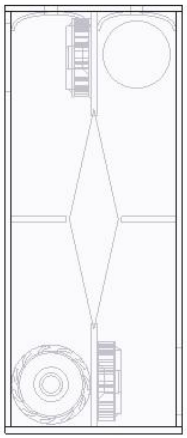


Airflow Exiting

Airflow *Entering*

Closed Loop





RESTCo concept HRV – built and tested by Carleton University Engineering students

The RESTCo House

Innovative twin core heat recovery HRV ventilator reduces freeze-up, sheds ice, improves IAQ (indoor air quality)

The RESTCo House

Engineering wood for dimensional strength and high strength-to-weight ratio

Wood materials can be packed flat to save shipping space

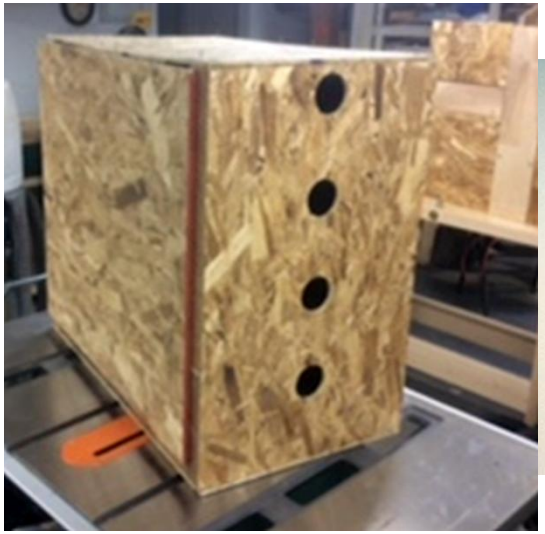
The RESTCo House

If there is a major problem with the location, the support legs can be attached to wheels, skis, floats or skids, and the structure moved

Building the RESTCo House

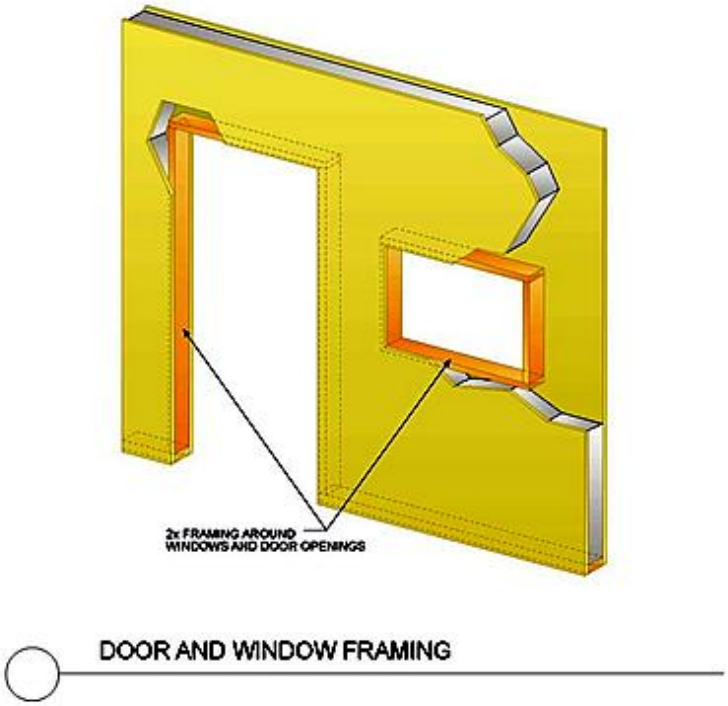
The main components can be assembled in the community in a mobile factory, such as on a barge or an inflatable building with walls made of seacans, creating local jobs and knowledge

Building the RESTCo House



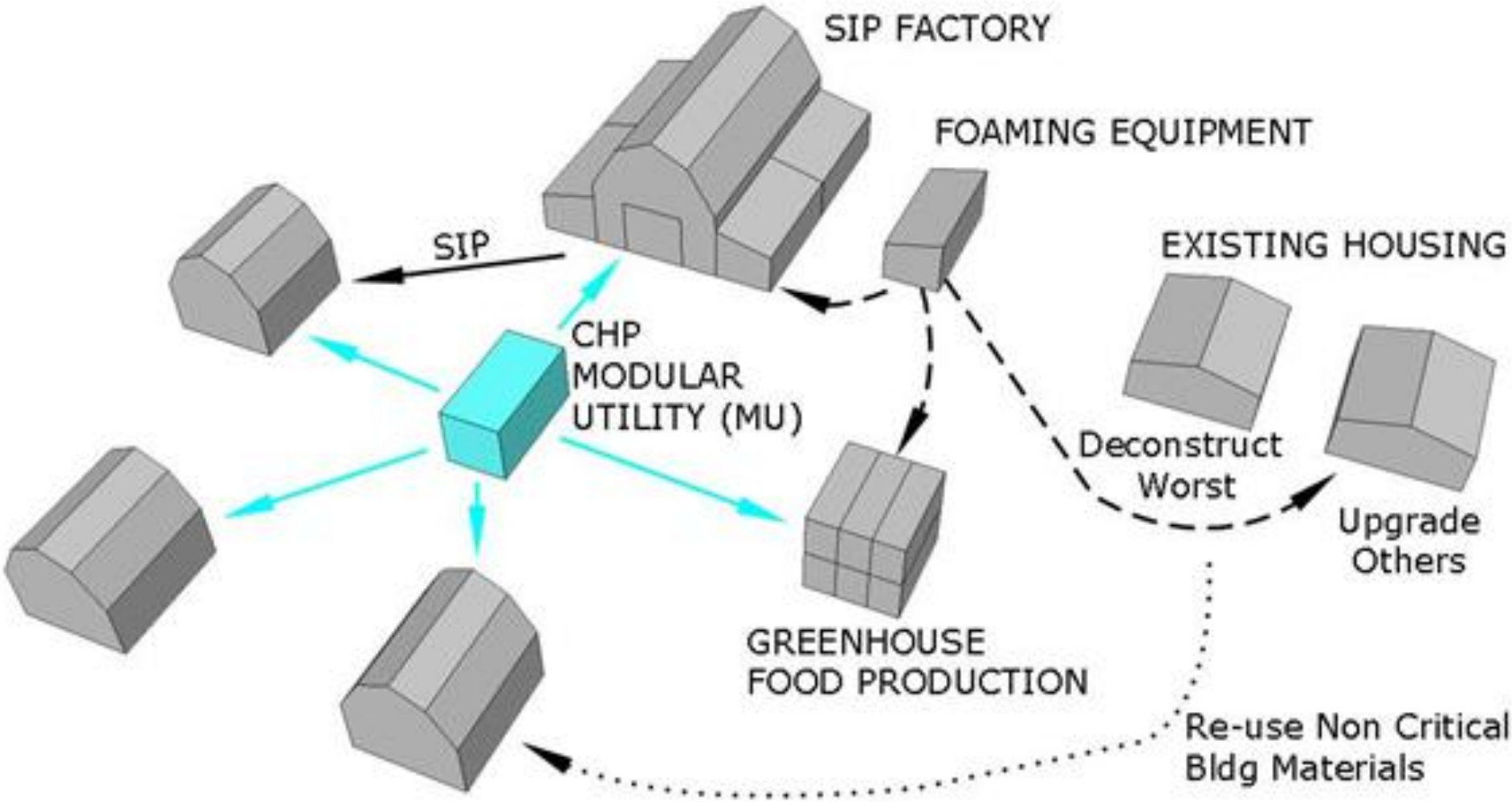
Structural Insulated Panels (SIP) are assembled in the community, and filled with foam which expands by factor 100, saving on shipping space

The RESTCo House

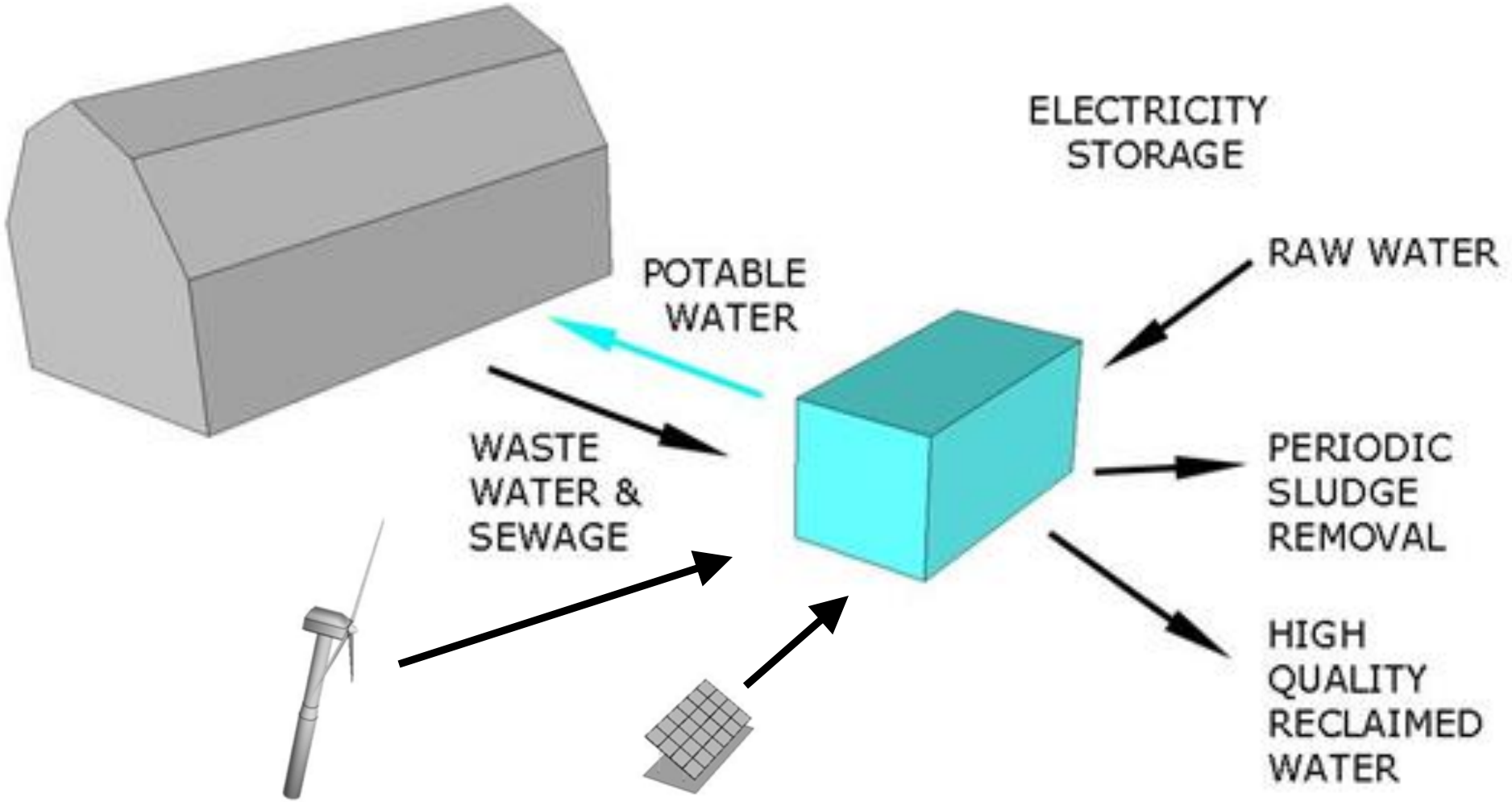


Make the sections with openings for doors and windows in the community, then move pieces to site for assembly

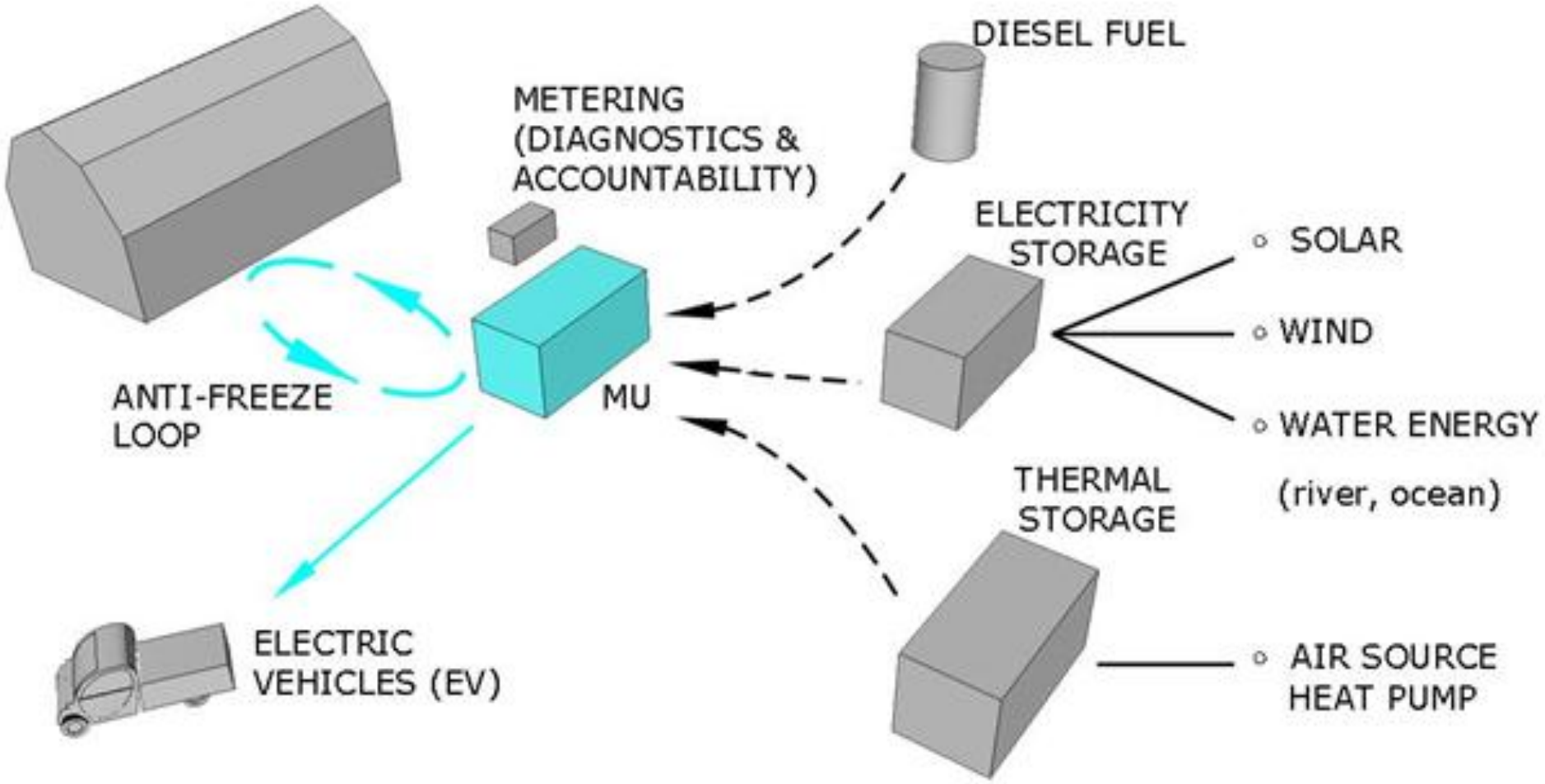
Building the RESTCo House



Energy and Utilities



The RESTCO House + Modular Utilities + Diverse Energy Supply + Food Supply



Modular Utility provides potable water, electricity, heat and wastewater treatment

Which means valuable conditioned space inside the house is available as living space

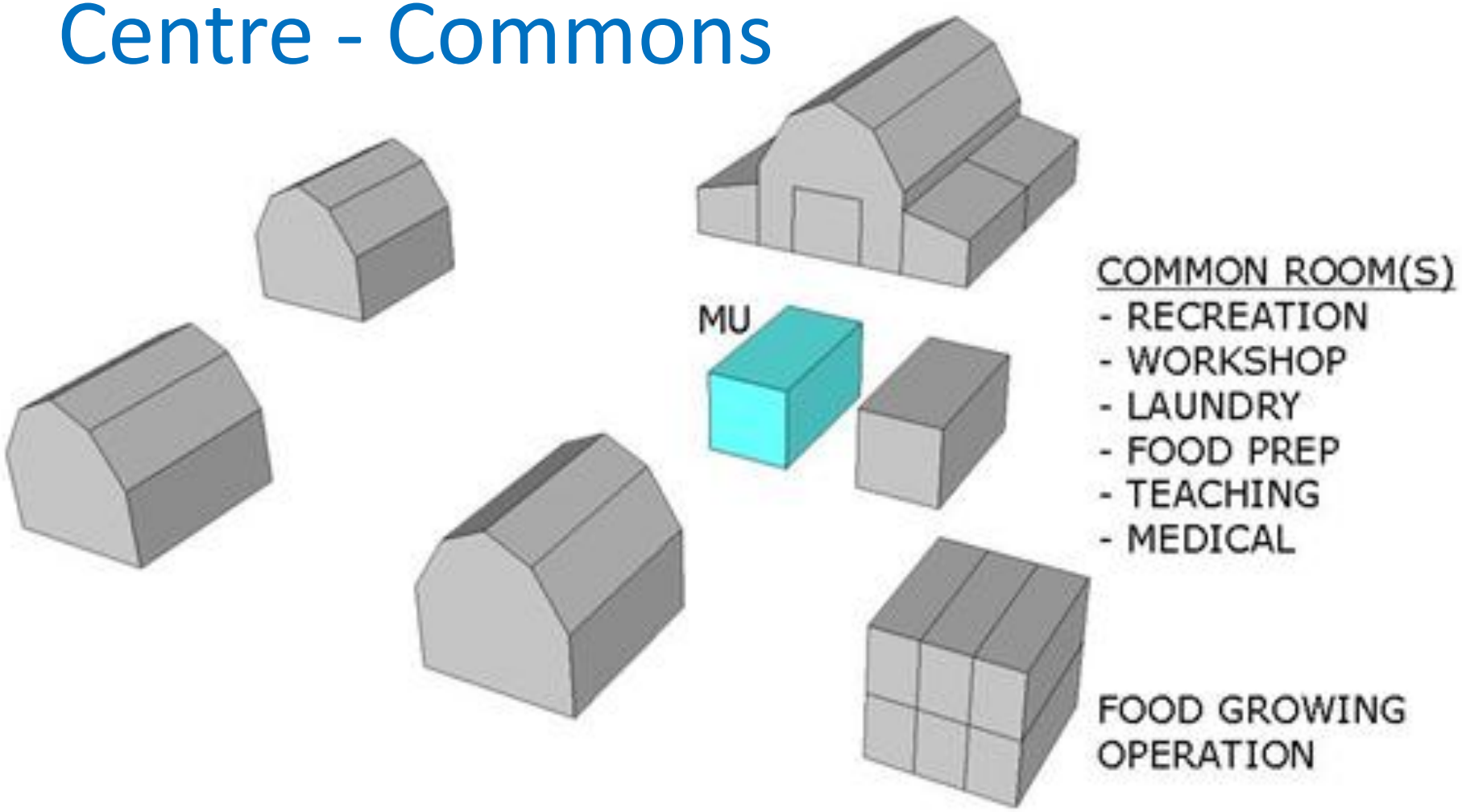
Renewable energy (solar, wind, biomass) can be captured for household use

Primary energy source is redundant small diesel engines, reducing load on central generator

In the event of a major problem
with current location,
the Modular Utility can be moved,

just like the RESTCo House.

Arctic and Northern Community Centre - Commons



What if your water infrastructure includes this? How can you reduce that oil use and GHG emissions?

How about larger versions of these zero-emissions electric trucks?

Lav Service

Water Service

Utility

Refuse

100 km range (loaded) at speeds to 60 km/h

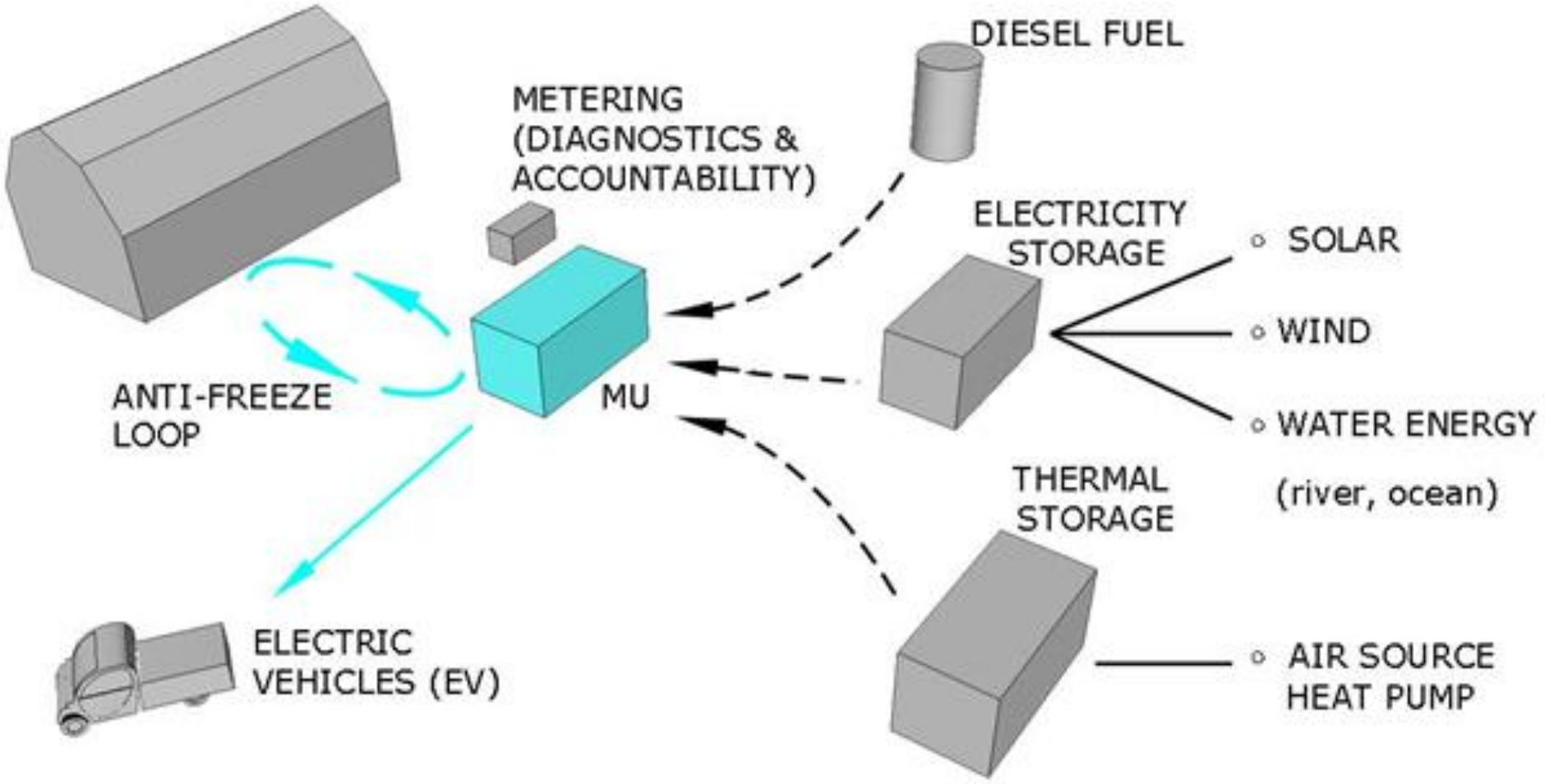
4-tonne battery electric truck, 150 km range (loaded) at highway speeds

The RESTCo House Strategy

Make a better house for the north

- robust, durable, energy-efficient, healthy
- don‘t waste indoor space on utilities
- reduce dependence on imported diesel
- movable if necessary
- support with modular, movable utilities
- food security
- create jobs and skills in the community
- plan for climate change impacts

The RESTCO House + Modular Utilities + Diverse Energy Supply + Food Supply



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