

# PANGNIRTUNG, NUNAVUT



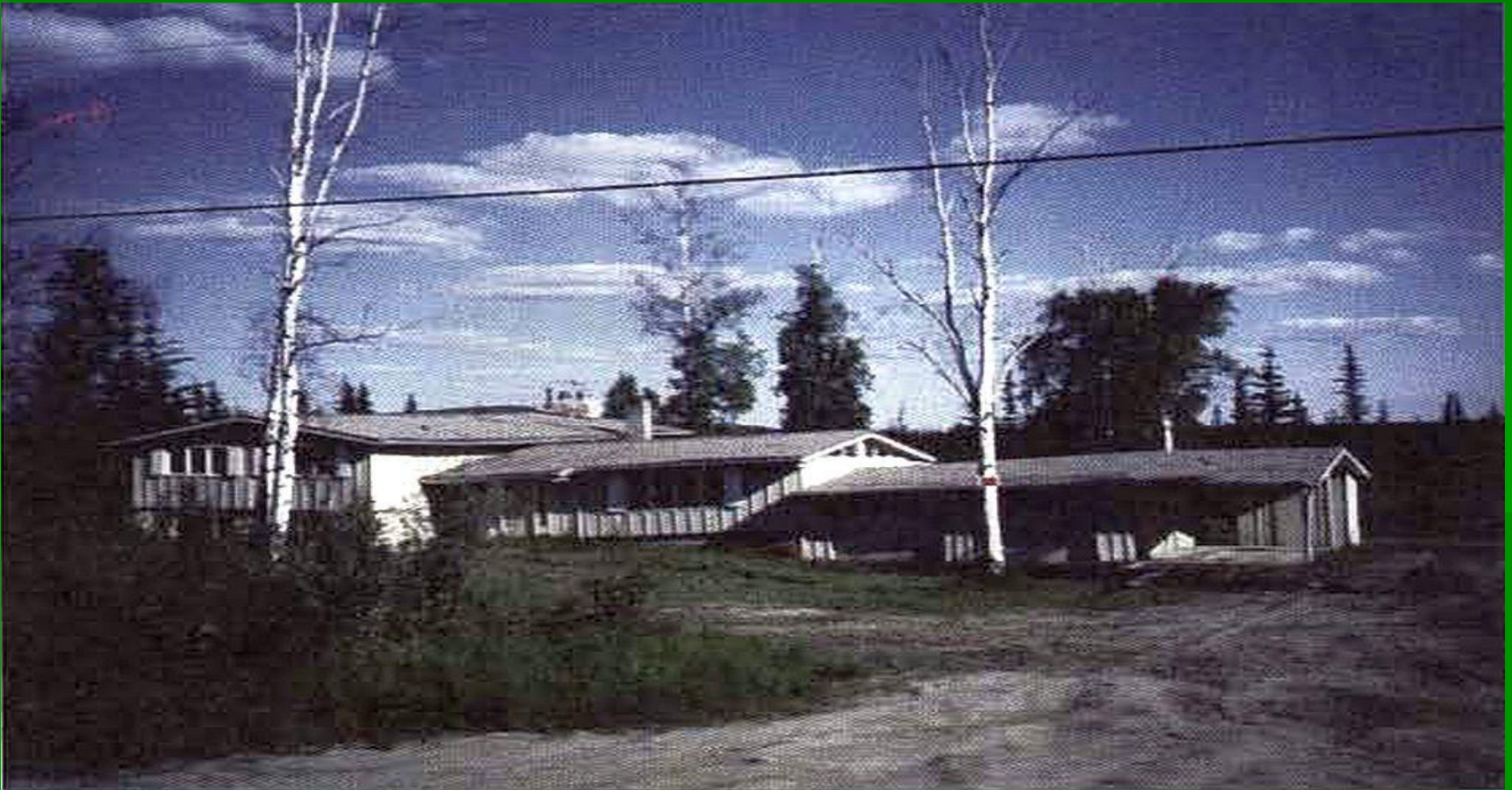
# VULNERABLE COASTAL COMMUNITIES







# PERMAFROST - FAIRBANKS



# FLOODING IQALUIT



# RESISTANCE TO CHANGE HAS BECOME DANGEROUS

## INFLUENCES ON HOUSE DESIGN :

### PAST & PRESENT:

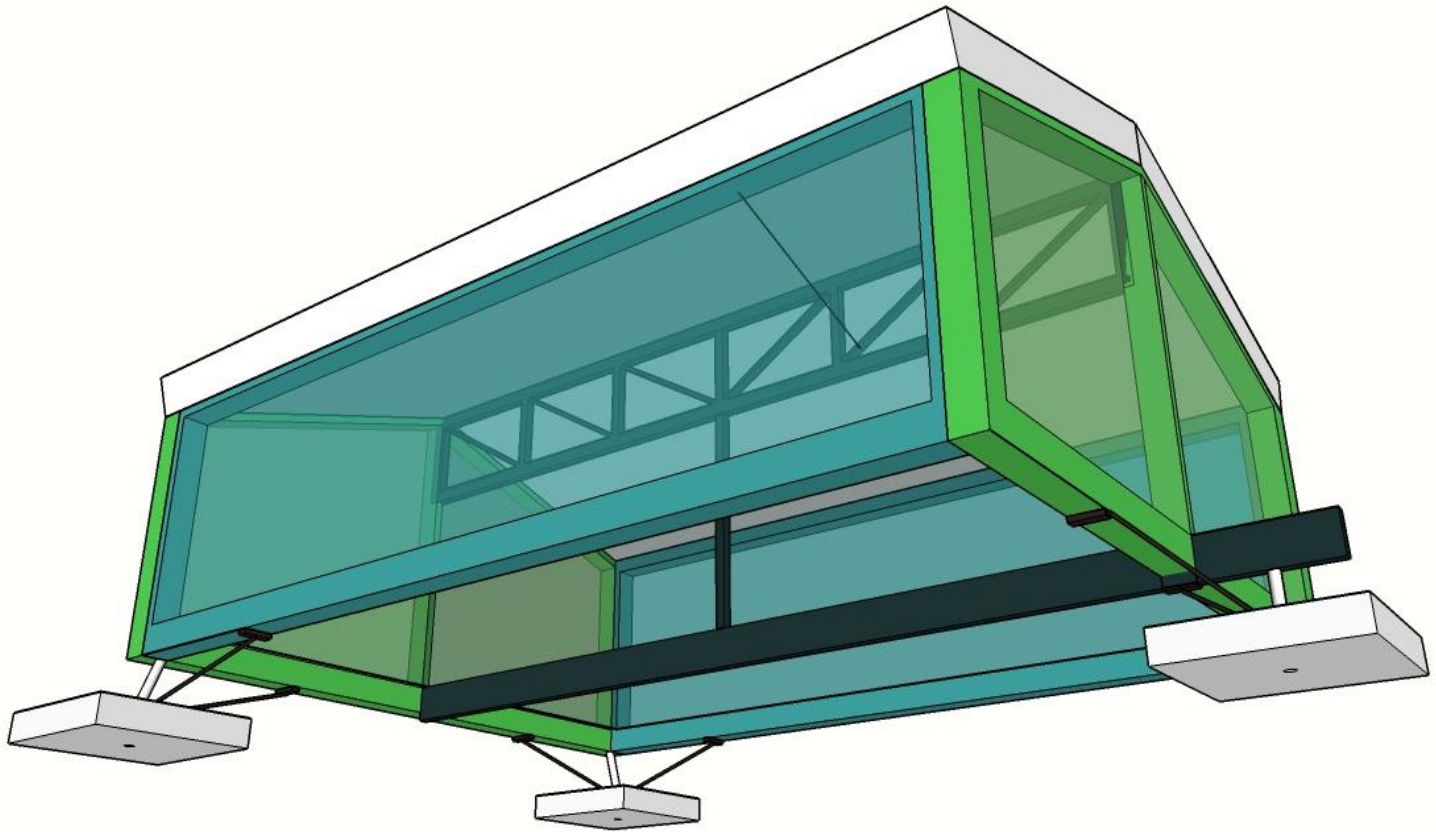
- Climate
- Construction practice
- Building materials industry
- Codes & Standards
- Culture
- Money for northern housing construction & maintenance

### FUTURE – DEMANDS ADAPTABILITY

Semi-predictable & Unpredictable Changes in:

- Climate
- Land stability
- Demographics
- Fuel price/availability
- Renewable energy technology
- Material science
- Communications
- Transportation
- Resource development
- Political commitment to remote communities

# TRIPOLAR HOUSING



STIFF FRAME – SUSPENDED FLOOR

# TRIPOLAR HOUSING

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SURVIVES PERMAFROST

ENERGY INDEPENDENT

HEALTHY

ADAPTABLE

AFFORDABLE

CONSTRUCTABLE IN REMOTE REGIONS

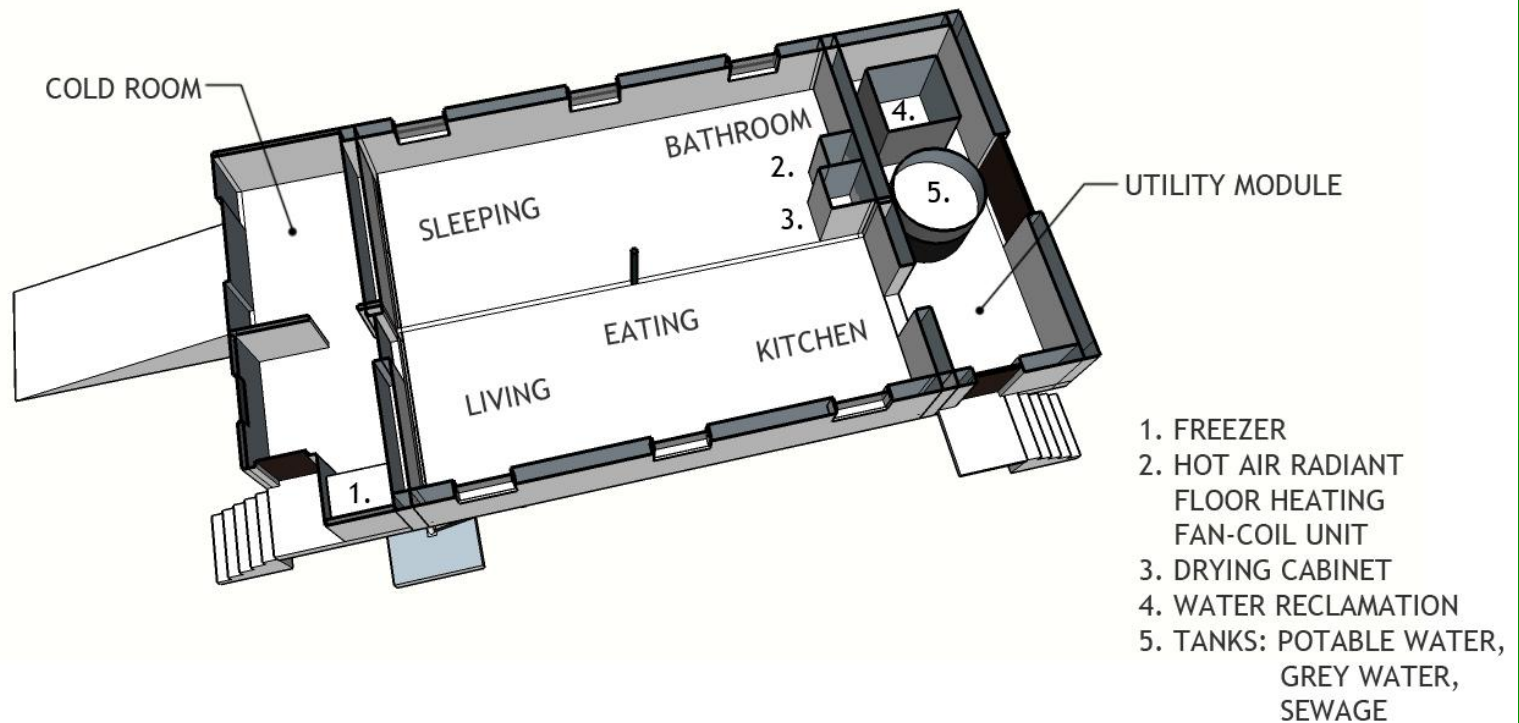
RELOCATABLE



# TRIPOLAR HOUSING

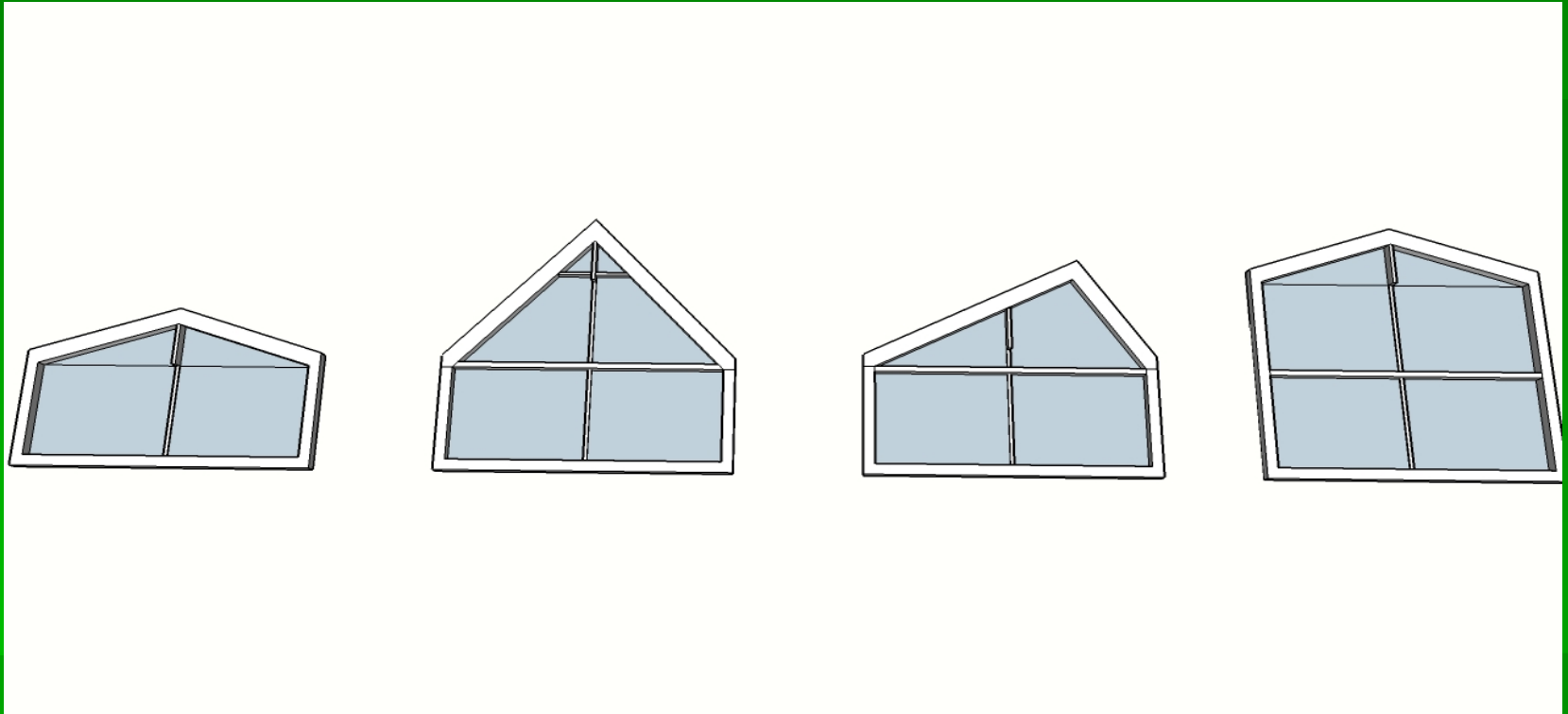


# Tripolar Housing



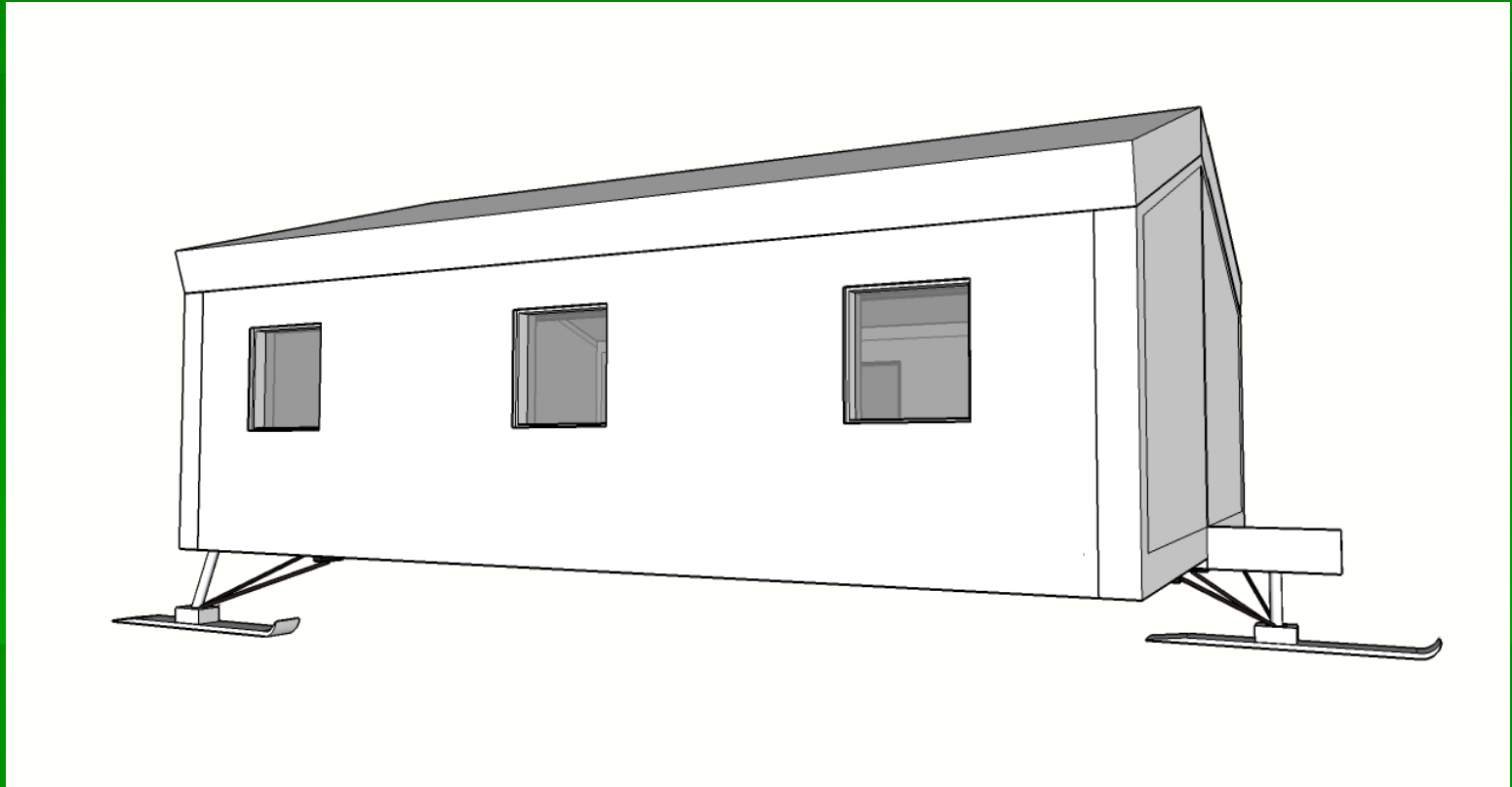
COLD-ROOM - CORE SPACE - UTILITY MODULE

# Tripolar Housing



**MULIPLE CROSS-SECTIONS POSSIBLE**

# Tripolar Housing



**TRANSPORTABLE ON SKIS, WHEELS, FLOATS, DIRIGIBLES**



# House envelopes can be remarkably strong



# The Strength of Modular Homes



# MOVING HOUSES IN THE FUTURE



Dirigibles

# STRATEGIES TOWARDS OIL INDEPENDENCE:

- LINKED TO SUSTAINABLE COMMUNITY CONCEPTS
- ALLIED WITH RESTCo's OBJECTIVES
- BENEFITING FROM SUCH INITIATIVES AS CMHC'S EQUILIBRIUM HOUSING

## REDUCE DEMAND

- SUPER INSULATION
- PERMANENT AIRTIGHTNESS
- REGIME OF IMPLEMENTING MOST COST-EFFECTIVE USE OF ELECTRICITY
- DESIGNED-TO-SURVIVE STRUCTURE & ENVELOPE

## INCREASE ENERGY STORAGE

- THERMAL
- ELECTRIC VEHICLE BATTERIES
- OTHER

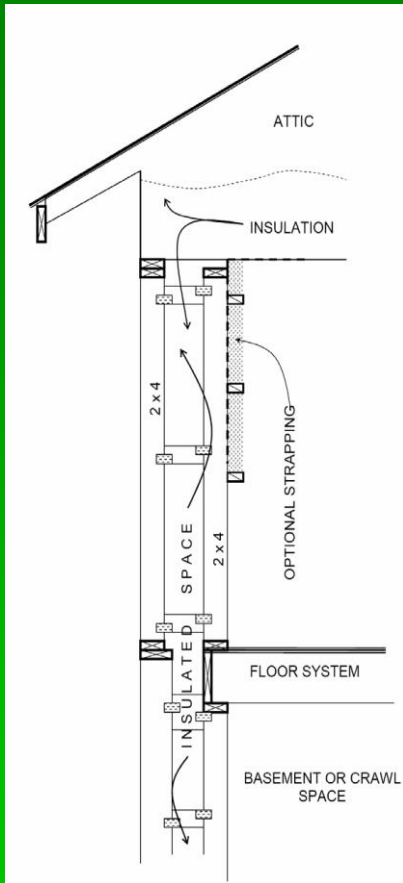
## INCREASE RENEWABLE ENERGY SUPPLY

- PASSIVE ENERGY DESIGN
- FROM*  
DIESEL/RENEWABLE COGEN
- TO*  
EXCLUSIVELY RENEWABLE ELECTRICITY GENERATION



# Super Insulation

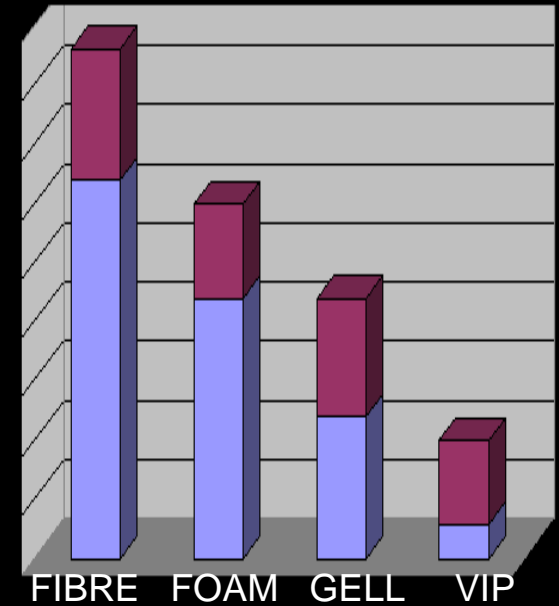
R- 80 ROOFS R-50 WALLS



CELLULOSE



VACUUM  
INSULATION PANEL  
(VIPS)



# NUNAVUT HOUSING AS SUPPLIED BY DAC-INTERNATIONAL



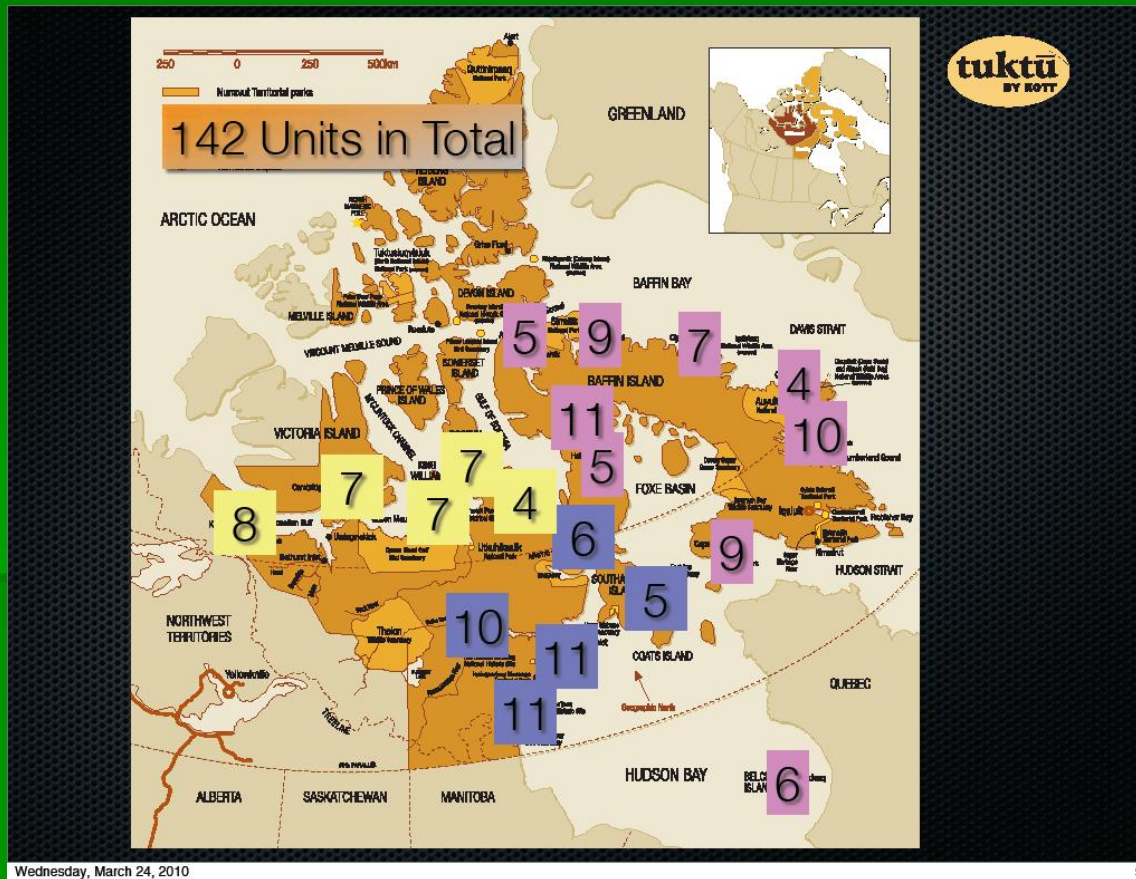
DAC –International Structural Insulated Panel (SIPs)  
Housing for Nunavut 2010 -

# SEALIFT



Nunavut East Arctic Shipping

# Distribution of DAC homes to Nunavut - 2010





# Manufacture in the north ?



# **Multiples - Inuvik**



MULTIPLES POSSIBLE WITH 3-POINT + COMPLIANT FOUNDATIONS

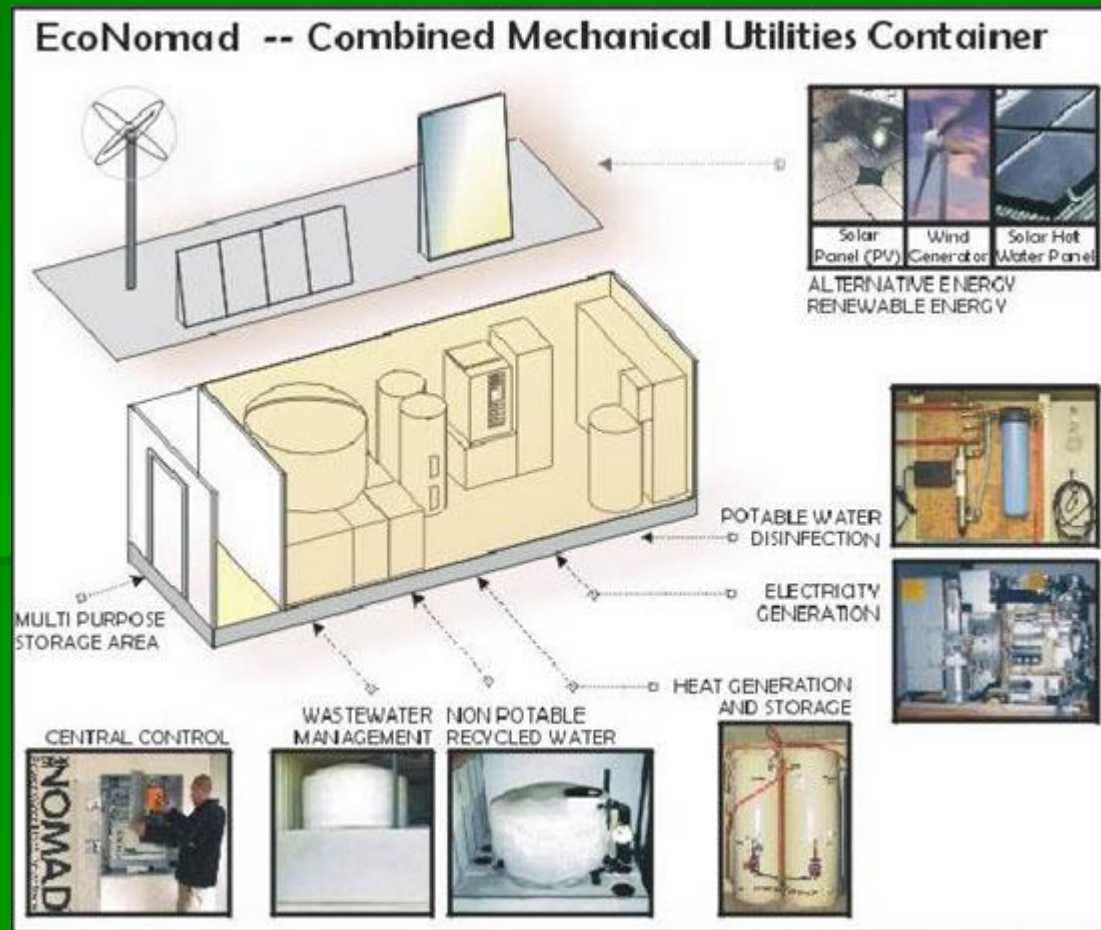
# ***TRIPOLAR HOUSING***

FOR LARGER FOOTPRINT HOUSES & OTHER BUILDINGS

- 3 adjustable anchor supports + multiple compliant foundation struts



# EcoNomad Utility module 10 years ago



# EcoNomad in Torngat National Park, Labrador 2010





# Tripolar Housing

# WHO

- Anna Dunets- Wils regionalArchitects / rePlan / architecturalAlliance, Toronto
- Prof. Kim Pressnail Sustainable Buildings Group, University of Toronto
- Peter Russell & Associates, Ottawa
- Looking for
  - an Arctic resident representing Northern/Inuit culture
- Possibly others

# Tripolar Housing

# How

- Phase 1 Pro bono team to prepare a proposal for funding from stakeholders and agencies
- Phase 2 – Preliminary Engineering & Economic Feasibility
- Phase 3 - Detailed Engineering, Construct and Test Prototype
- Phase 4 - Field Testing
- Phase 4 - Production

# ACKNOWLEDGEMENTS

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- Chris Ives (ex-CMHC), Eria EcoSystems (sustainable community design)
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- Bob Platts P. Eng., building technology expert
- Dr. Virginia Salares (ex-CMHC), indoor air quality
- Bill Dawson P. Eng., Descon (light gauge steel structures)
- Grant Morrison (ex-CMHC), northern and remote housing
- Tom Livingston, P. Eng., Regional Municipal Engineer, Cambridge Bay
- Tom Kerwin, CMHC, Manager, northern housing
- Fanis Grammenos (ex-CMHC), architect (Urban Pattern Associates)
- Barry Craig, architect, CMHC Research (Equilibrium House, Yukon)
- Chris Beuglet P. Eng., Ecologix Inc. (HVAC engineers and manufacturers)
- Dr. Phaguni Mukhopadhyaya, NRC, insulation expert
- Mark Douglas, NRCan (MCHP)
- Robin Sinha P. Eng., Director, Sustainable Energy Research Centre, Carleton University
- Dr. Don Onysko P. Eng., wood engineer (ex-Forintek)
- Hank Starno, President, Manufactured Housing Institute Canada
- Udo Staschik, architect, Architectural & Community Planning. Inc. (modular utilities)
- Bill Vangool P Eng., President, Triodetic (space frames), Arnprior
- Bill Semple, CMHC Research Division, responsible for Northern Housing
- Dr. Greg Kopp, Boundary Layer Wind Testing Laboratory, Western University
- Tom Green, CMHC Research Division, Manager Equilibrium Program
- Clive Clark, retired from Ferguson Simak Clark, architects & engineers, Yellowknife