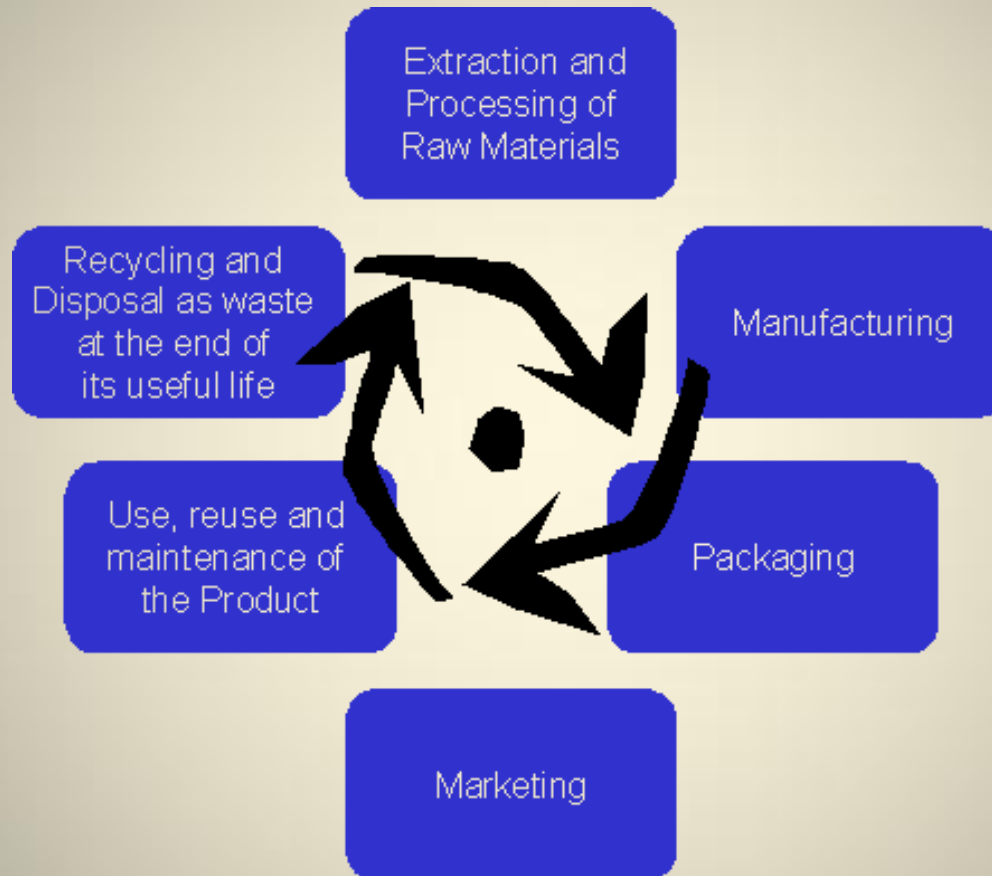


# Life Cycle Analysis of the Canadian Wood Pellet



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# What is Life Cycle Analysis (LCA)?



# 4 Steps for a Complete LCA

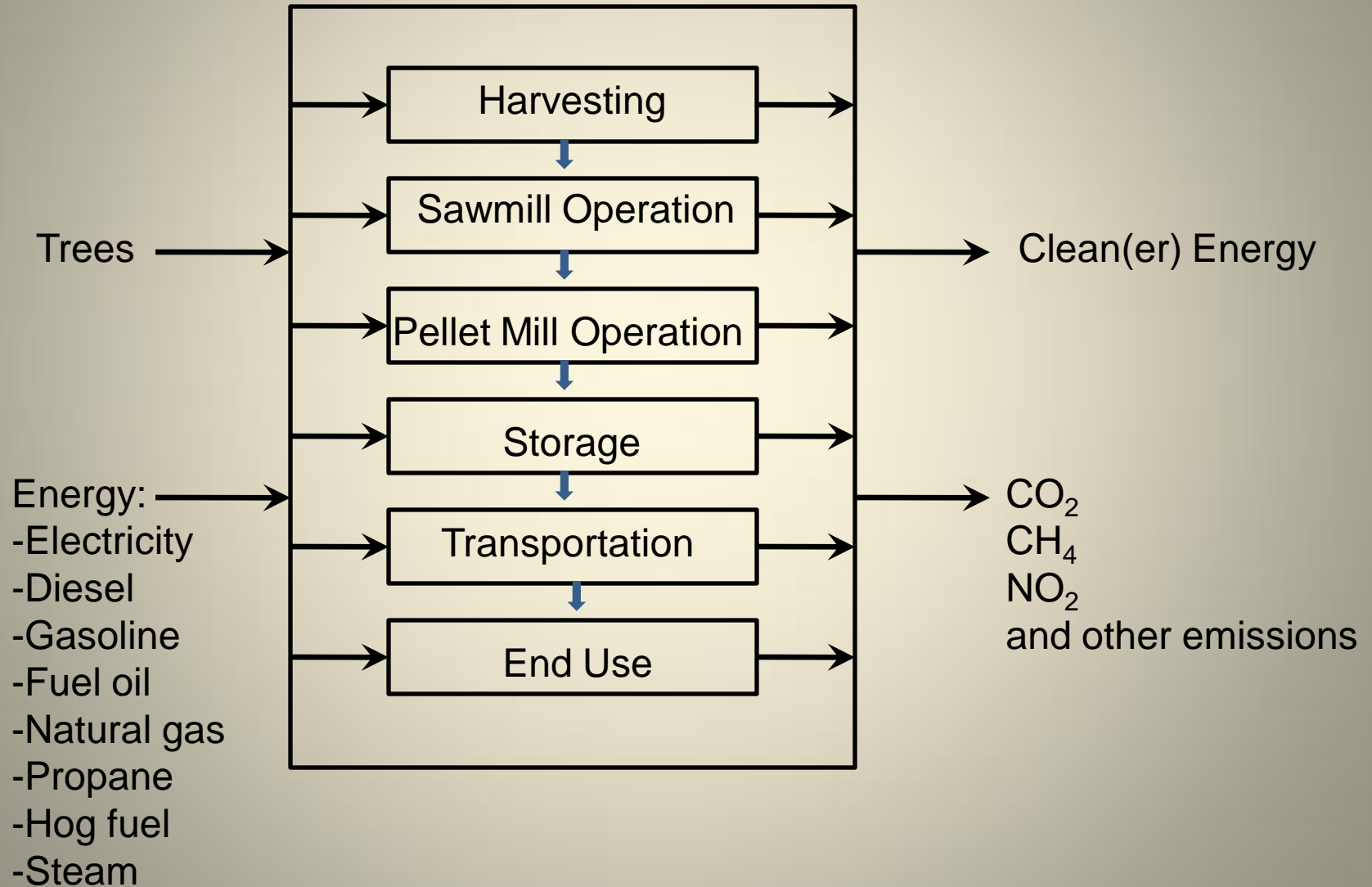
1. Define the scope, boundary, and functional unit
2. Create the life cycle inventory
  - material and energy inputs/outputs
3. Complete the life cycle impact assessment
  - Global Warming, Acid Rain, Smog Formation
4. Interpret assessment

# Wood Pellet LCA will help:

- Demonstrate product as a clean alternative energy
- Recover product energy efficiency and fossil fuel content
- Aid in sustainable biomass certification
- Conduct feasibility studies for future wood pellet plant design



# Wood Pellet Life Cycle Boundary



# Scope and Functional Unit

Scope: onsite fuel consumption emissions and upstream emissions from fuel production

Functional Unit: 1 tonne of wood pellets





# Information We Have So Far

## Harvesting

- **Source:**

Forest Engineering Research Institute of Canada

- **Energy consumption:**

- Diesel



## Sawmill Operation

- **Source:**

Canadian Industrial Energy End-Use Data  
and Analysis Centre of SFU

- **Energy consumption:**

- Electricity
- Middle Distillates
- Natural Gas
- Propane
- Heavy Fuel Oil
- Wood Waste



# Information We Have So Far

## Transportation

### •Source:

- GHGenius Model of Natural Resources Canada
- Environment Canada

### • Energy Consumption:

- Diesel, Gasoline, Fuel Oil

truck



ocean freighter



train





# Missing information

## Pellet Plant Operation and Wood Pellet Storage

- **Information Needed:**

- Fuel and Electricity Consumption
- Feedstock and pellet characteristics
- Inventory of machinery involved in pelleting process



# Survey Contents

# Feedstock Characteristics

- Average number of loads per week
- % shavings, sawdust and woodchips
- Moisture Content (%)
- Tonnage
- Distance traveled (km)
- Transporter and fuel type
- Average size of a load



# Pellet Characteristics

- Average number of loads per week
- Average size of a load
- Moisture Content (%)
- Tonnage
- Distance traveled (km)
- Transporter and fuel type
- % bulk shipped versus bagged
- Calorific value





# Pellet Plant Equipment Inventory/Operation

- Receivers
- Dryers
- Hammer Mills
- Pellet Mills
- Pellet Coolers
- Ventilation
- Shipping



Image Credit: <http://www.lameccanica.it/page.jsp>

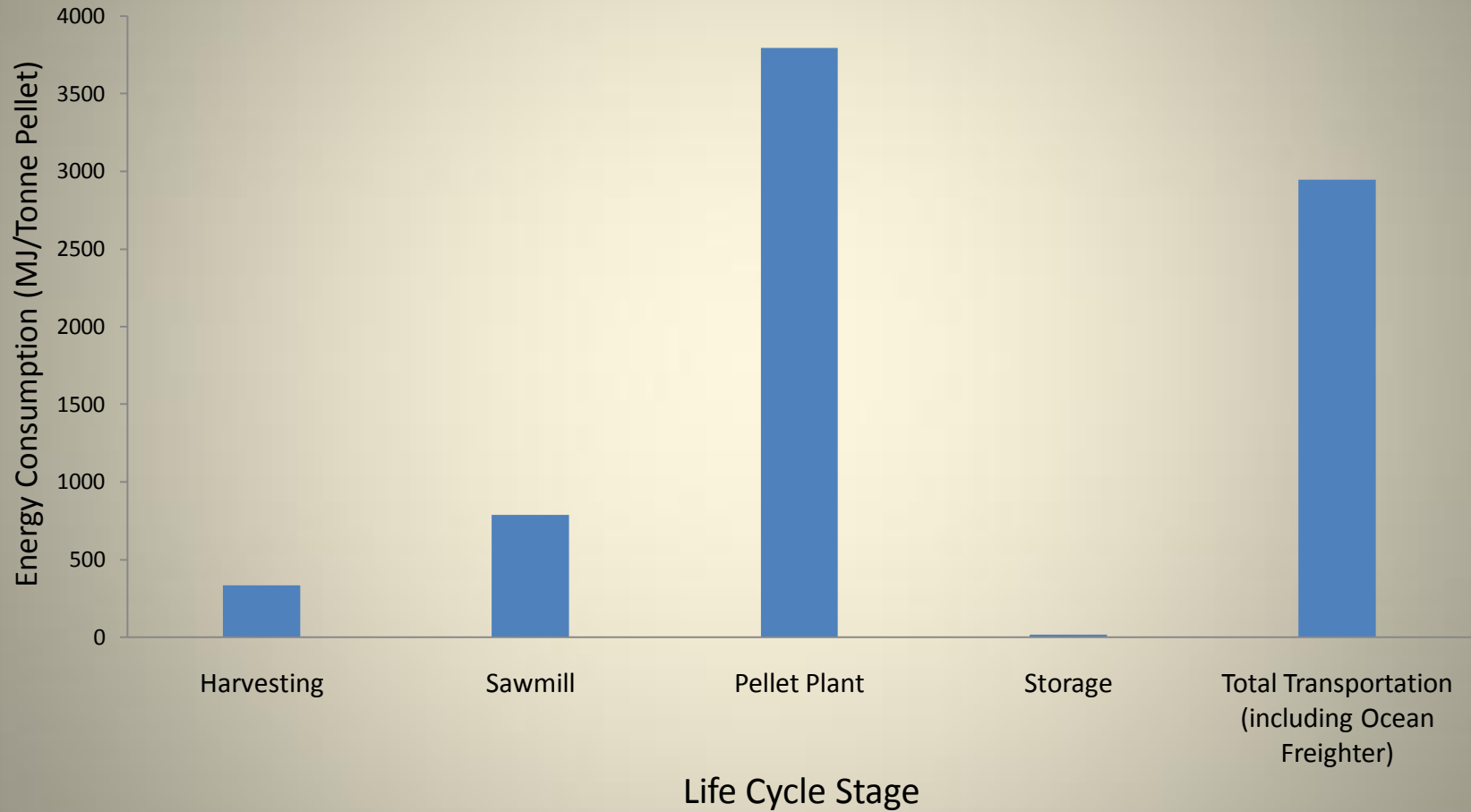
# Overall Plant Energy Consumption

- Electricity
- Natural gas
- Propane
- Diesel
- Wood Waste and/or Pellet Fines



# Preliminary Results

# Energy Consumption By Life Cycle Stage





# Europe Bound Pellets

For one Tonne Wood Pellets:

- Total upstream fuel consumption is **7.8 GJ**
- Of that, **3.8 GJ** from fossil fuels, **4.0 GJ** from renewable fuels

For a Wood Pellet with a heating value of 18 GJ/tonne:

- Total Fuel Consumption (or penalty): **43%**
- Total Fossil Fuel Consumption: **21 %**
- Total Renewable Fuel Consumption: **22%**

# Domestic (i.e. Vancouver) Bound Pellets

For one Tonne Wood Pellets:

- Total upstream fuel consumption is **5.2 GJ**
- Of that, **1.2 GJ** from fossil fuels, **4.0 GJ** from renewable fuels

For a Wood Pellet with a heating value of 18 GJ/tonne:

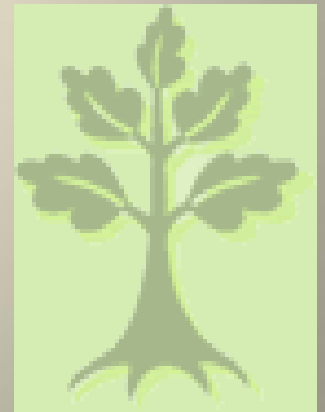
- Total Fuel Consumption (or penalty): **29%**
- Total Fossil Fuel Consumption: **7 %**
- Total Renewable Fuel Consumption: **22%**

# Recommendations for Future Work

- Conduct site visits and interviews to complete pellet plant survey
  - Confirm information from survey
  - Educational Opportunity for student
- Investigate energy consumption allocation to the sawdust and shavings in the sawmill
- Compare Wood Pellet LCA to Natural Gas and Coal

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# Questions?



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