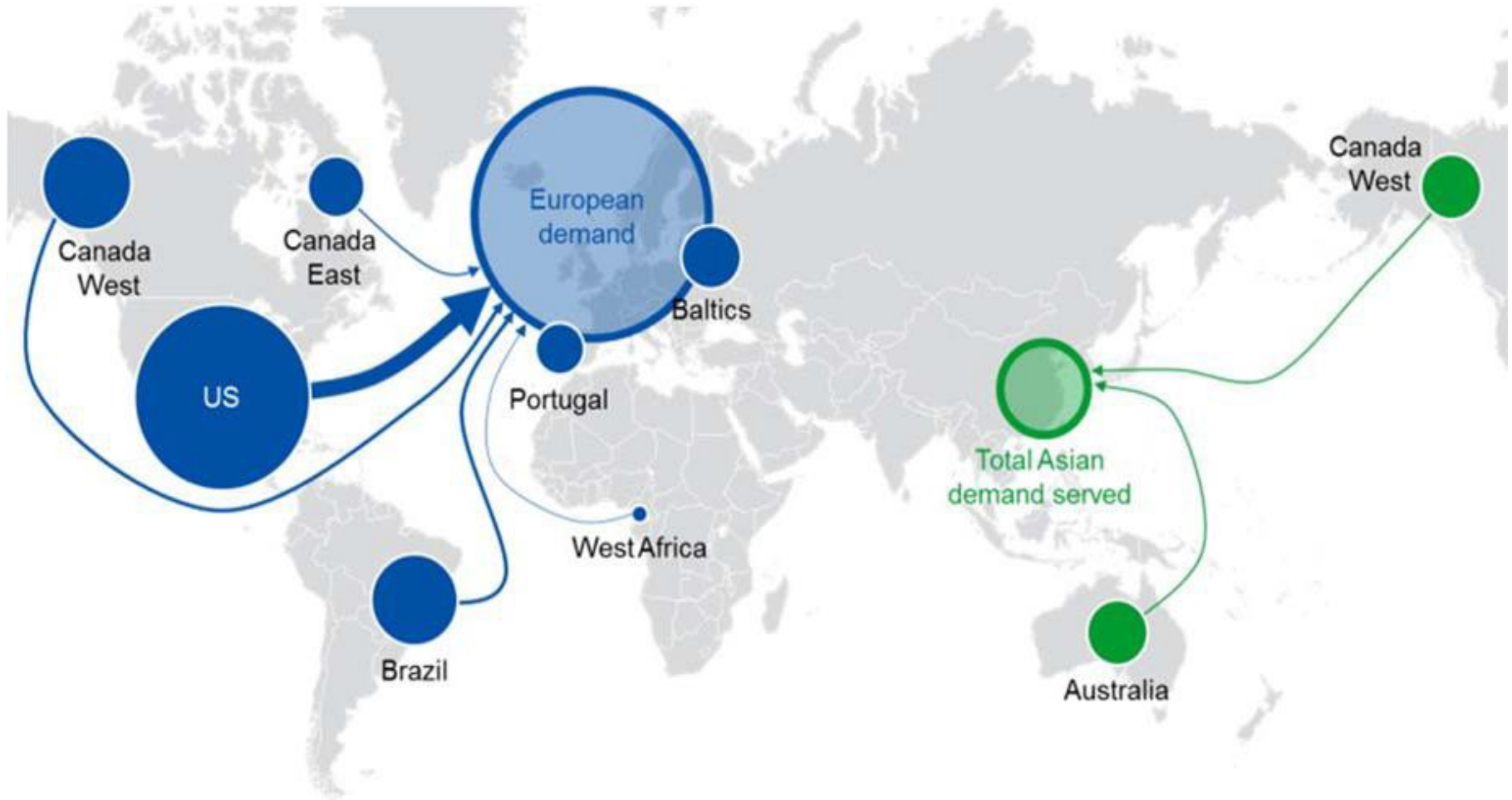


# **U.S. Pellet Market & Logistic Model**

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Edgar Blanco (MIT)  
PFI Annual Conference 2014  
Orlando, FL**

# Pellet supply chain



# Pellet supply chain

Wood pellets are distributed (depending upon end user needs) in:

- consumer-bags
- big-bags
- tank trucks
- containers
- railcars
- ocean vessels

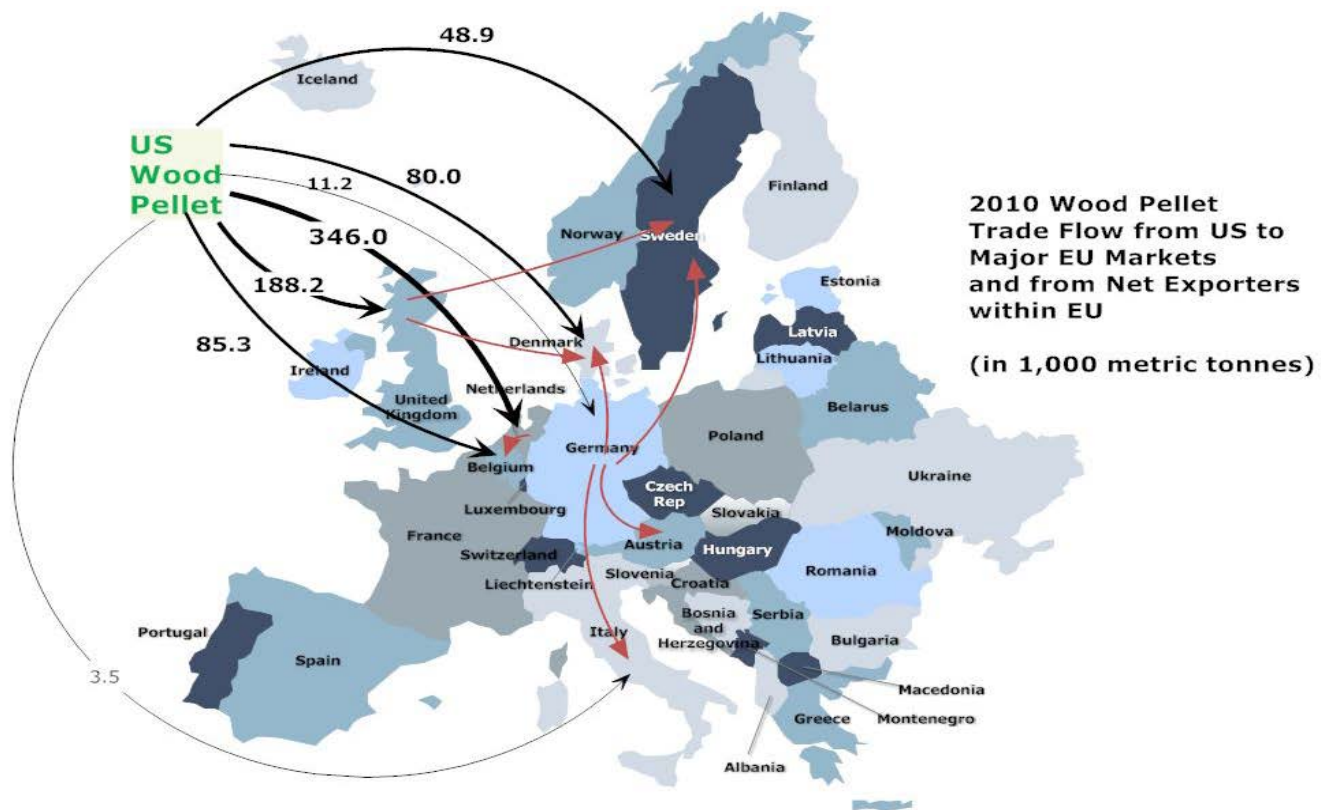


Source Argus: Safe Pellets



Source Argus: Georgia Biomass

# Europe



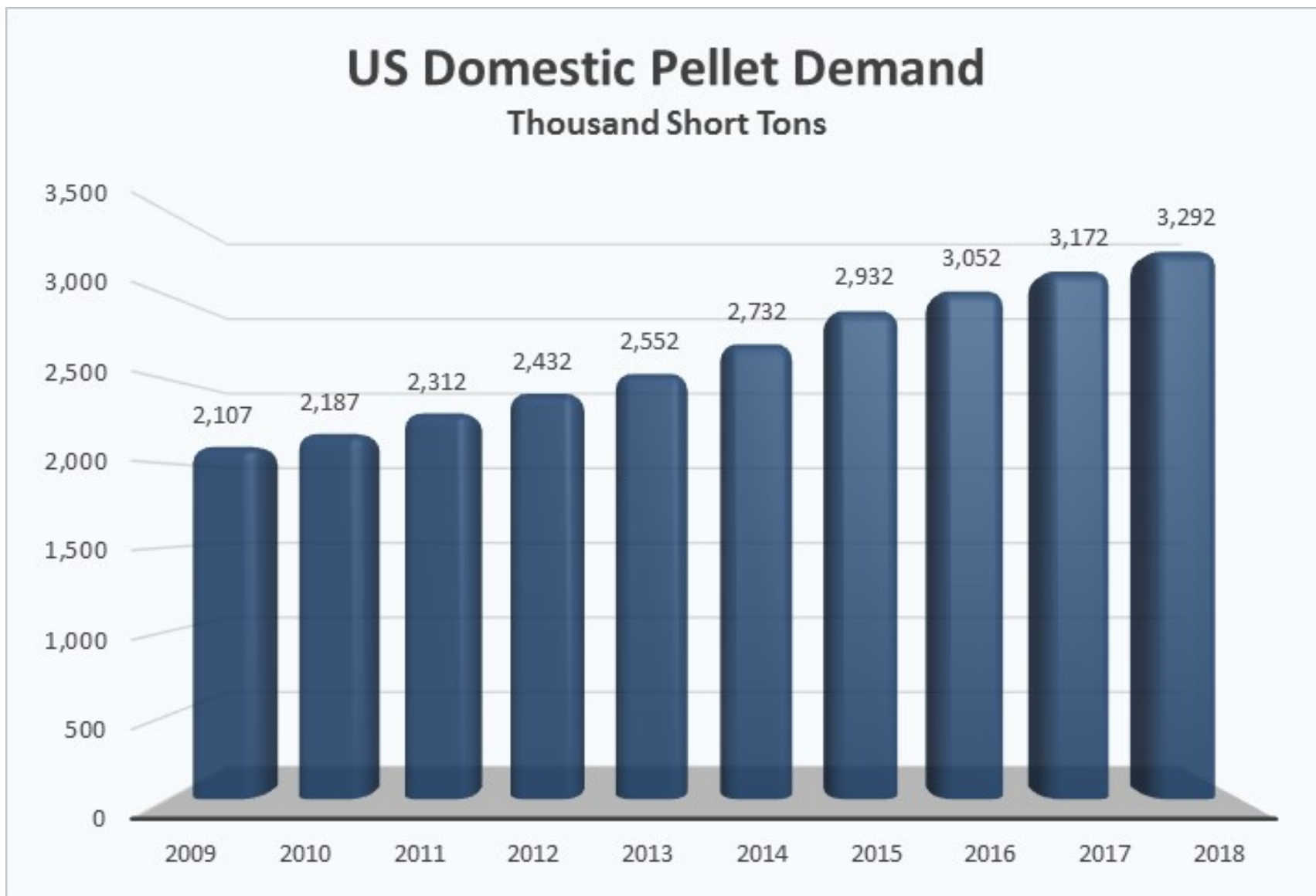
Source: U.S. Endowment for Forestry and Communities



U.S.



# Domestic Pellet Market

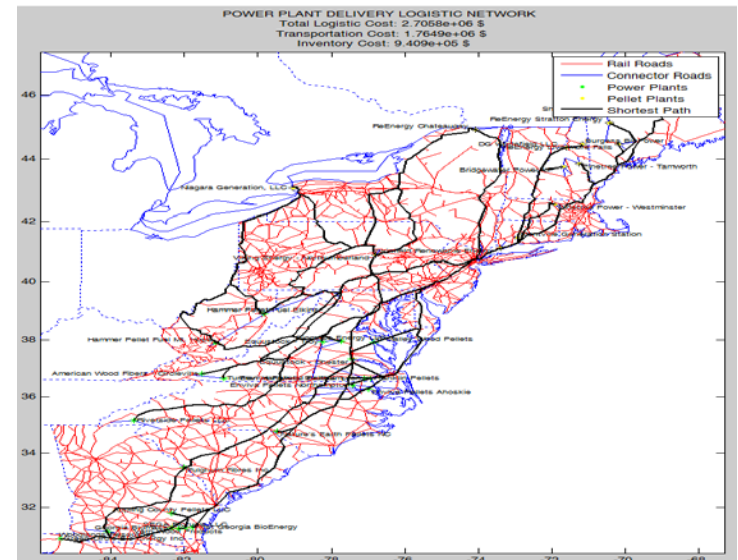
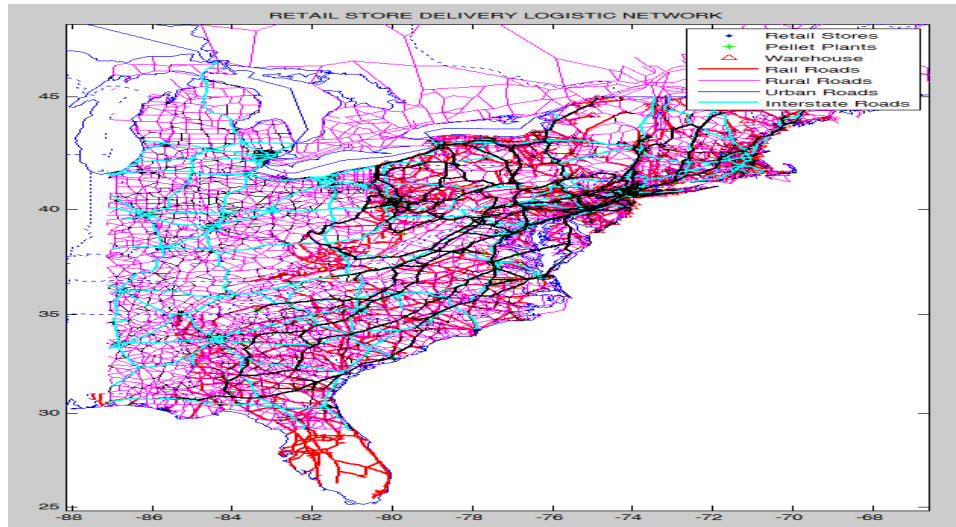


Source: Walker, Seth.. 2013. North American Wood Pellet Market.. RISI

# Model Development

**Objective:** Design a logistic network to supply wood pellets to customers at least cost possible providing the desired level of service

- The total cost of transportation and inventory is used to guide the design, subject to service level requirements
- The design problem includes the need to select the best location for the DCs in the network.



# Model Development

- Generally there is a trade-off between transportation and inventory cost
- Selecting the best mode of transportation between each point in the network

## Transport Modes

Mode	Costs in Cents per Ton-Mile
Water	0.007
Rail	0.025
Road	0.251
Air	0.588

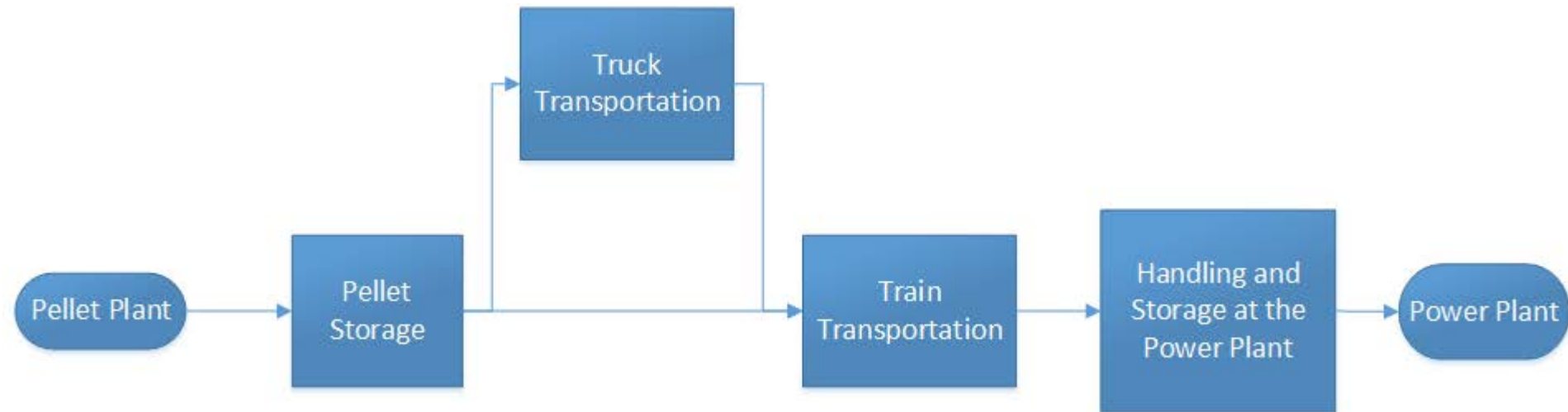
Source: Michael G. Kay

# Pellet Delivery Methods

- Bagged pellets for residential heating (Retail Store)
- Bulk for Power Plants



# Bulk for power plants

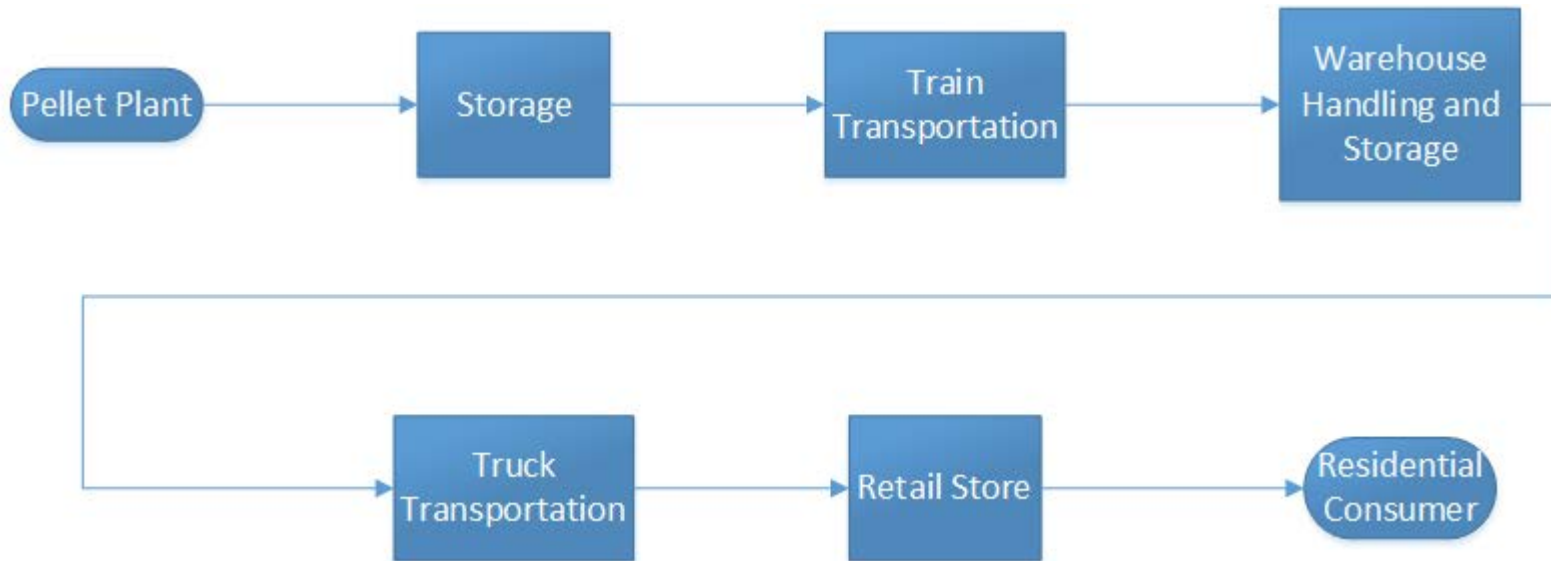


# Bulk for power plants



-84 -82 -80 -78 -76 -74 -72 -70 -68

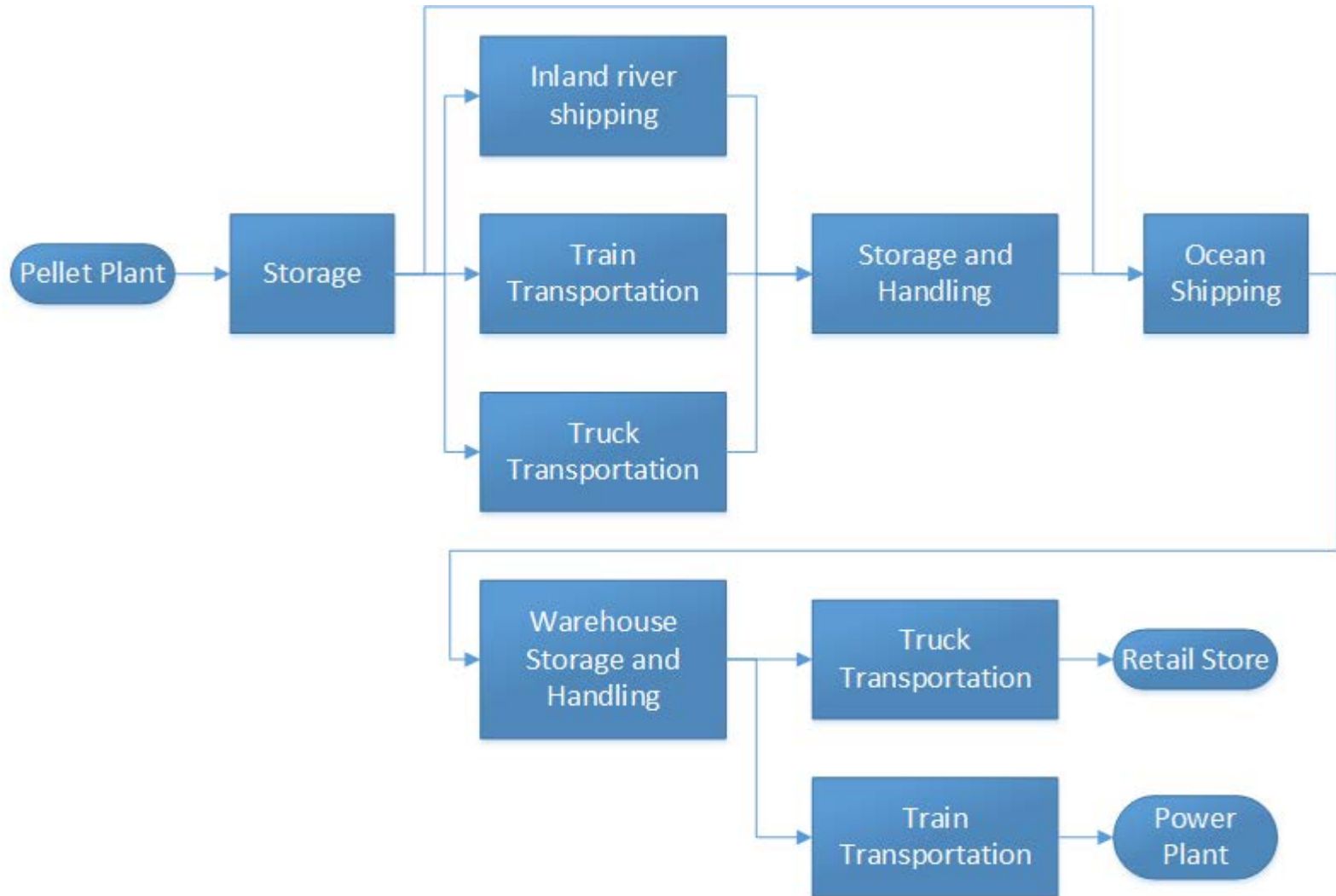
# Bagged for residential



# Bagged for residential



# Ocean shipments





# Ocean shipments

Legislations issues : a 90-year-old law, called the Jones Act.

Every time you want to send something from one US port to another:

- the cargo must travel on a ship built in the US
- staffed by mostly Americans
- flying the American flag





Essentially, all models are wrong, but some are useful.

(George E. P. Box)

Source: IZquotes



# Bulk for power plants

Detailed Steps	Input Variable/Procedure	Output Variables
1. Supplier and Customer Location	Pellet Plant Location	
	Power Plant Location	
2. Create Railroad Network	Railroad Terminal/Nodes	Route distance
	Railroad Links (arcs or lanes)	
3. Allocate supply potential to power plants	Railroad transportation rate	Mass flow
	Supply potential	Total cost
	Demand	
4. Determine optimal shipment size, frequency and total logistic cost	Producer price index for CL	Shipment frequency
	CL revenue per loaded car-mile	Minimum total logistics cost
	Pellet density	Transport cost
	Weight capacity of trailer	Cycle inventory cost
	Cube capacity of trailer	
	Route distance	
	Expected annual demand	
	Average intershipment Inventory fraction at origin and destination	
	Unit value of shipment	
	Inventory carrying rate	

# Bagged pellets for residential heating

Detailed Step	Input Variable/Procedure	Output Variables
1. Retail Store Location and Demand Allocation	Locate Retail Stores	
	3-digit Zip Codes Location	
	Population (3-digit Zip Codes)	
	Residential Sector Biomass Consumption Estimates By State	
	Allocate Demand to retail Stores	
2. Supplier Location	Pellet Plant Location	
	Supply potential	
3. Locate Warehouses	UFL Procedure	NF location
	Fixed cost of establishing a new facility (NF)	Fraction of EF demand severed from NF
	Variable Cost to all of Existing Facility's (EF)	
4. Integrate Railroad and Highway network	Railroad Terminal/Nodes	Route distances
	Railroad Links (arcs or lanes)	
5. Allocate supply potential to retail stores	Railroad transportation rate	Mass flow
	Highway transportation rate	Total cost
	Aggregate demand	
6. Determine optimal shipment size, frequency, Total logistic cost	Producer Price index for CL	Shipment frequency
	CL revenue per loaded car-mile	Minimum total logistics cost
	Producer Price index for TL	Transport cost
	CL revenue per loaded truck-mile	Cycle inventory cost
	Pellet density	
	Weight capacity of trailer	
	Cube capacity of trailer	
	Weight capacity of truck	
	Cube capacity of truck	
	Route distance	
	Expected annual demand	
	Average intershipment inventory fraction at O-D	
	Unit value of shipment	
	Inventory carrying rate	