The Role of Forest Bioenergy in 2050 Low Carbon Scenarios

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GENERATION ENERGY
Moving Canada Forward

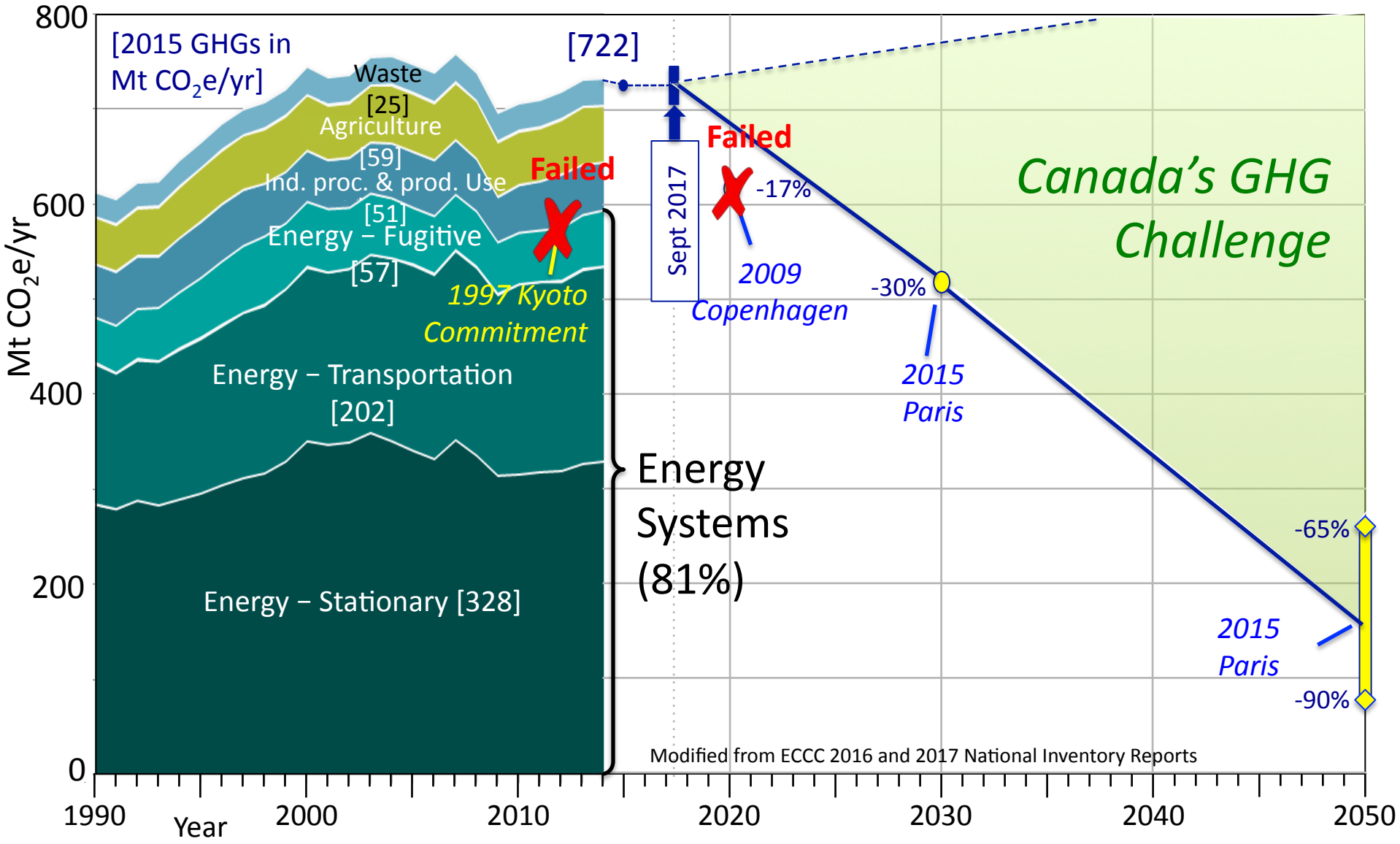
THE ROLE OF FOREST BIOENERGY IN CANADA'S ENERGY FUTURE

Canadian Museum of Nature, Ottawa – Sept 13, 2017

UNIVERSITY OF CALGARY

Canada's Greenhouse Gas (GHG) Emissions & Targets

CANADIAN ENERGY SYSTEMS ANALYSIS RESEARCH



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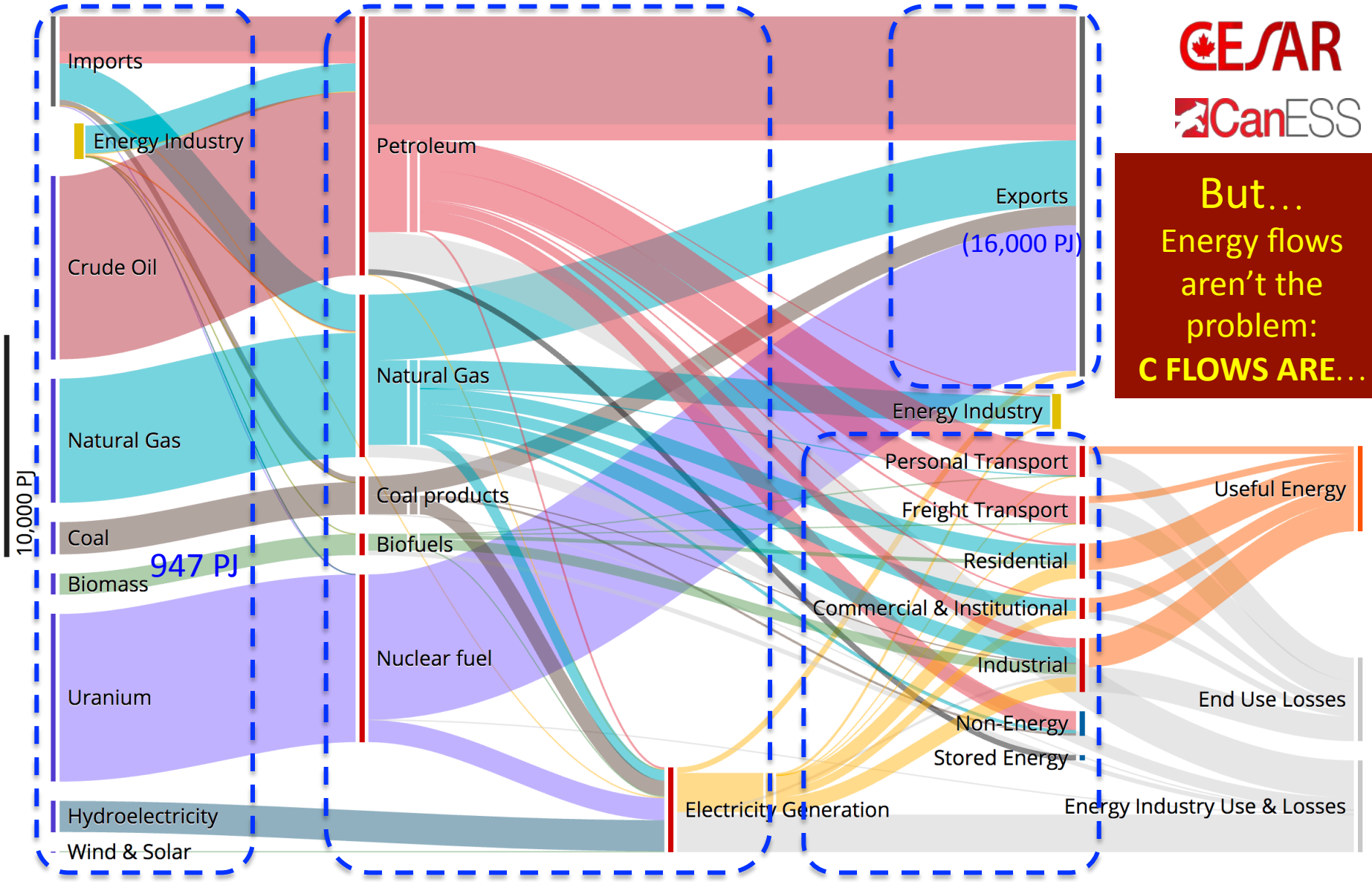
Outline

CESAR CANADIAN ENERGY SYSTEMS ANALYSIS RESEARCH

1. Canada's Energy Systems
   - ➢ *The magnitude of the challenge & opportunity*
2. Bioenergy in the Energy Systems of 2050
   - ➢ *'Prediction', assuming the world is serious about GHG reductions*
3. The Systems Challenge

Energy Flows -Total: Canada, 2013

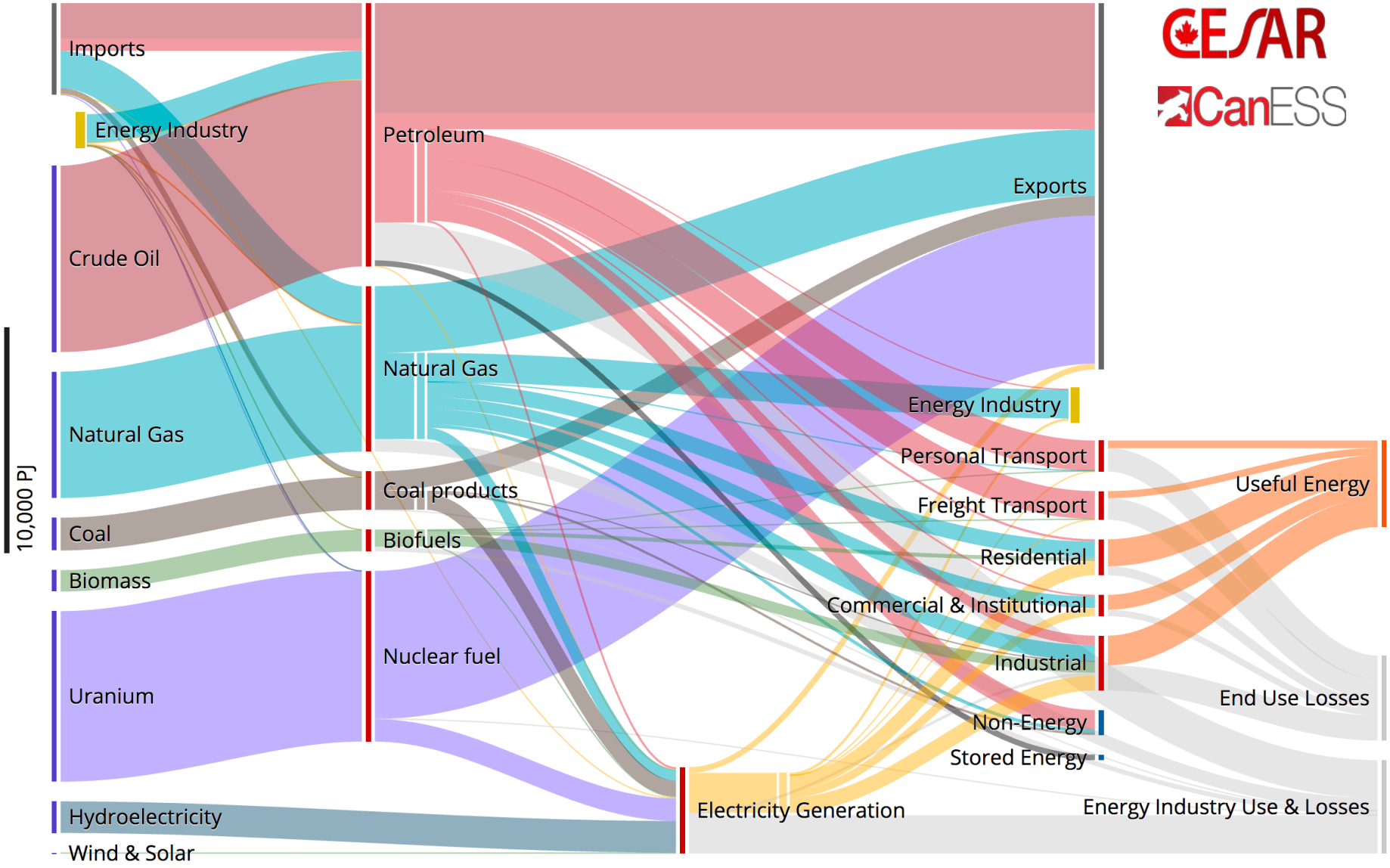


GESAR

CanESS

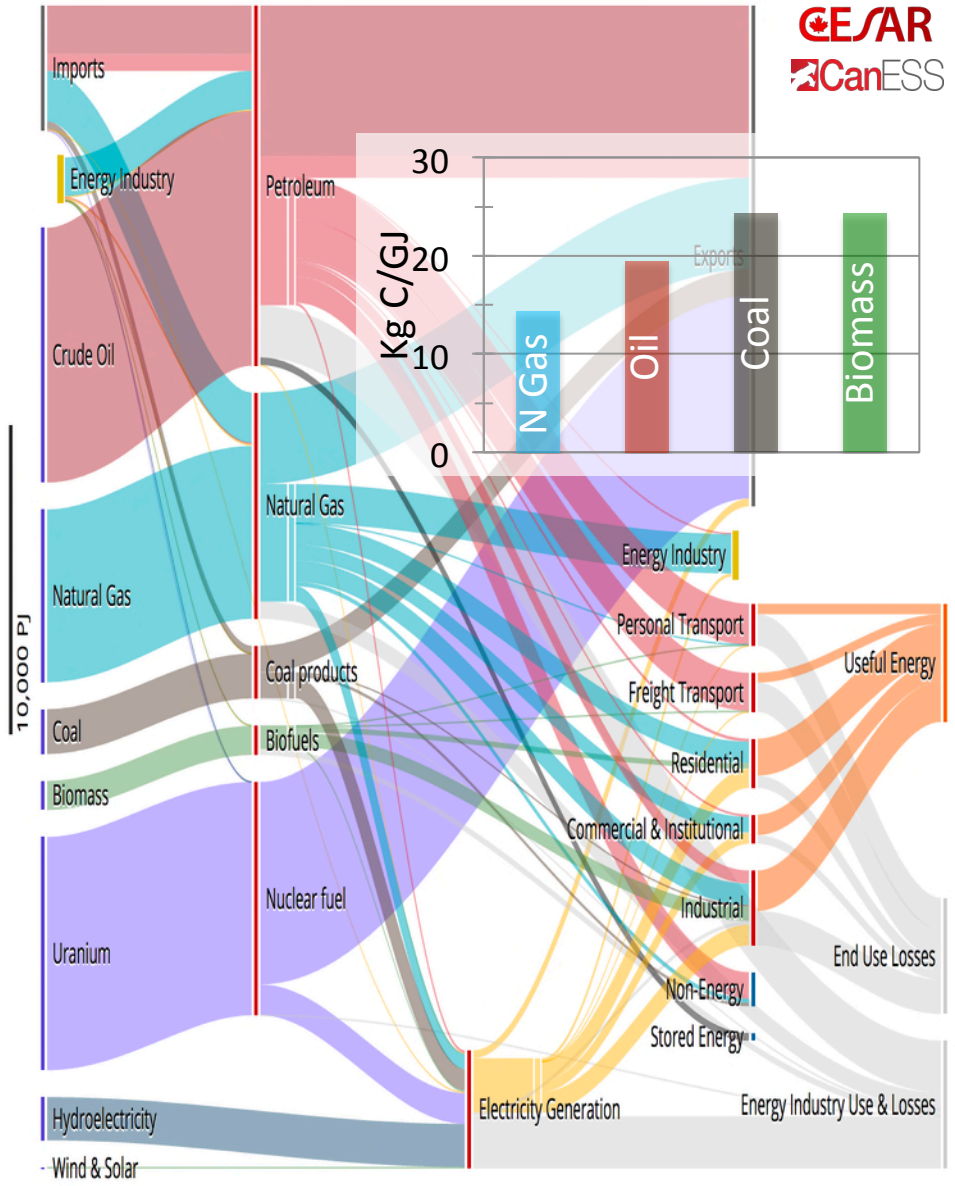
But…
Energy flows aren't the problem:
C FLOWS ARE…

Energy Flows -Total: Canada, 2013

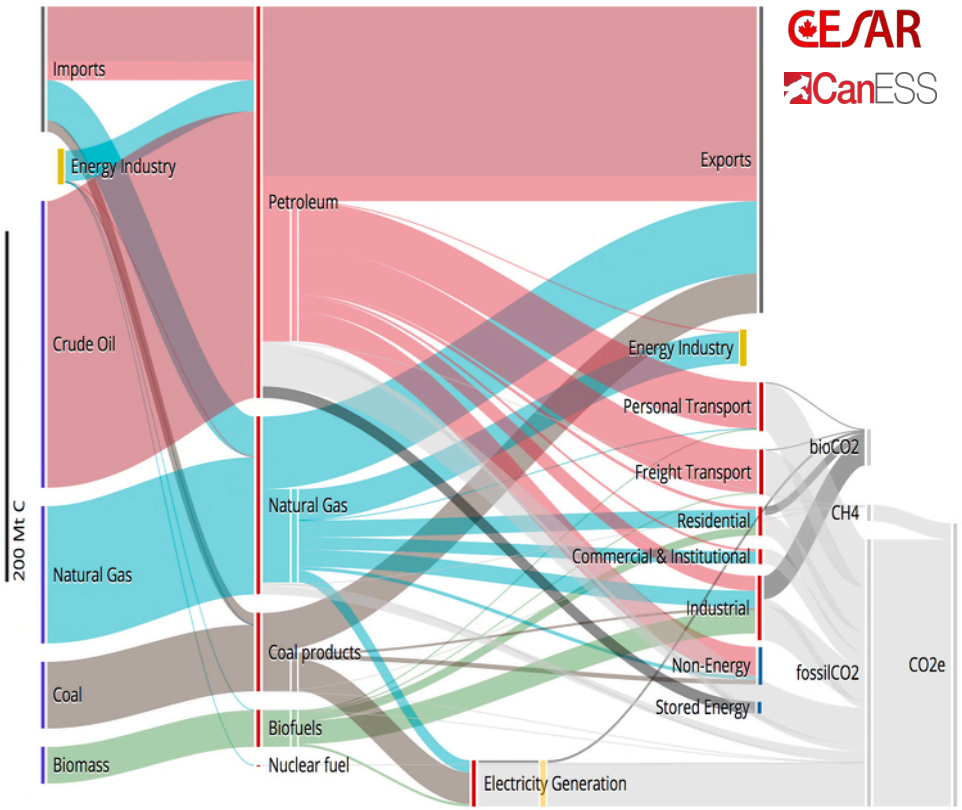


Total Flows – Canada, 2013

ENERGY



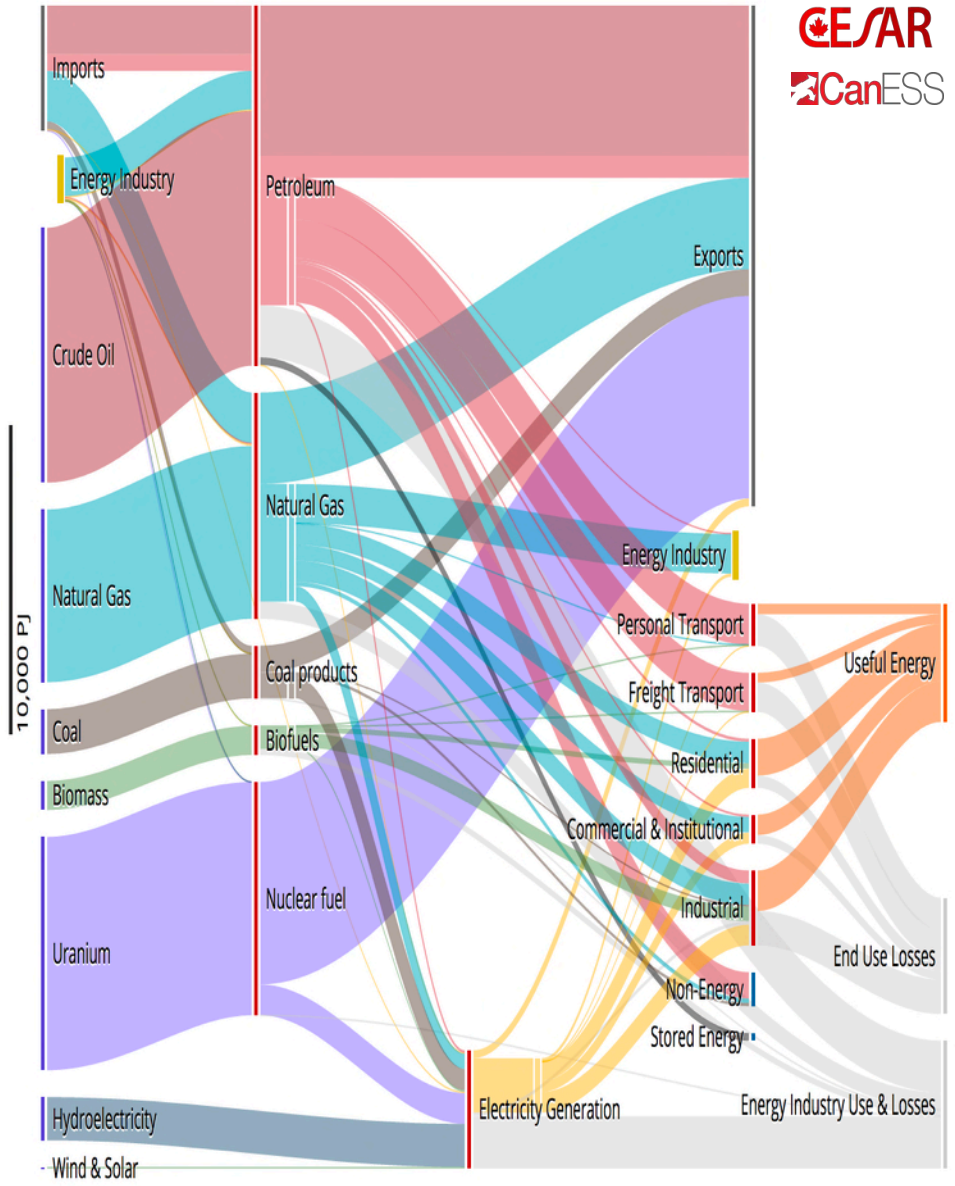
CARBON



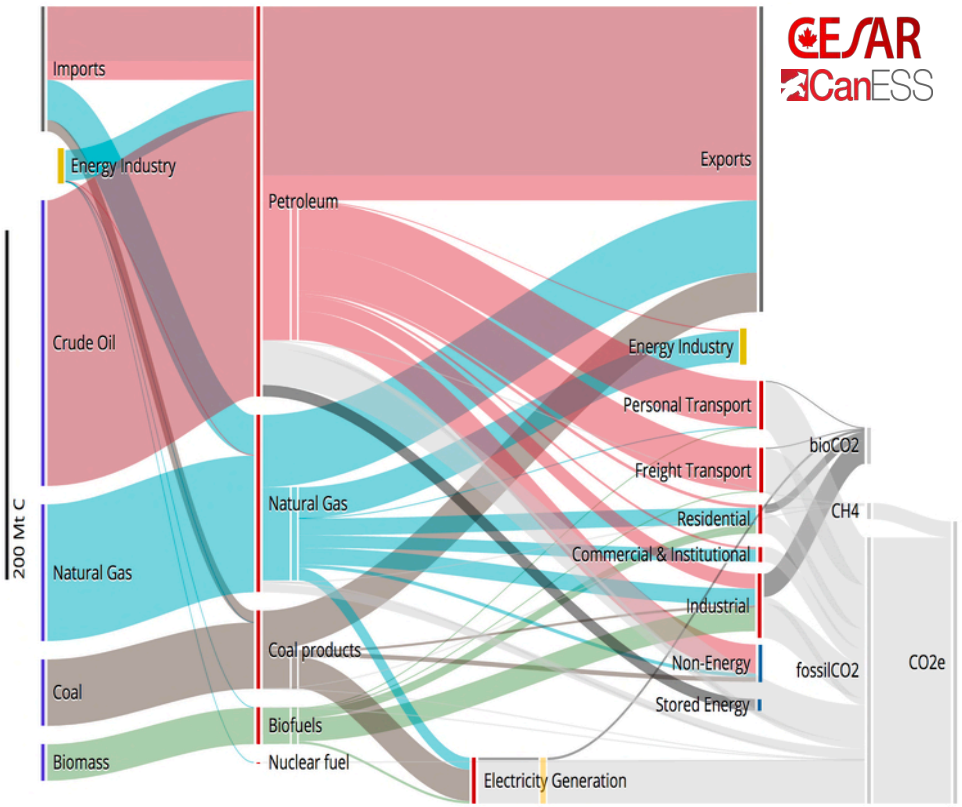
How would the C flows change if all Agriculture and Forestry were considered as part of energy systems?

Total Flows – Canada, 2013

Energy



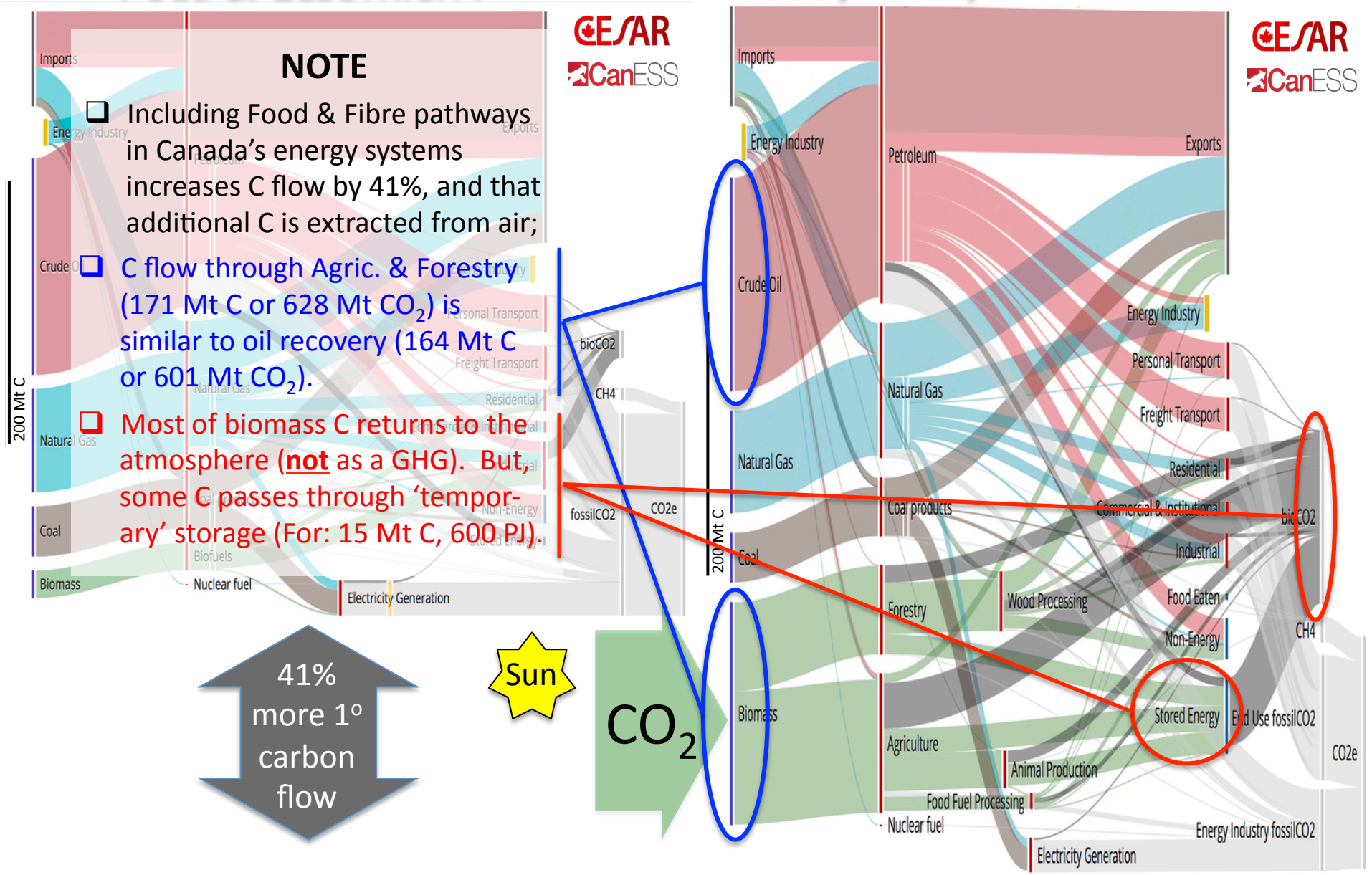
Carbon



Anthropogenic Carbon Flows – Canada, 2013

Fuel & Electricity

Food, Fibre, Fuel & Electricity



Forest Biomass Resource Potential

Primary Energy & Carbon Available

	PJ/yr	Mt C/yr
Forest Residues	370	10
Unused AAC	600	16
Bugwood	?	?
Fast Growing trees	?	?
TOTAL	**~1000+**	**~26+**

Conversion Efficiency to Biofuel

50%

500 PJ/yr

30%

300 PJ/yr

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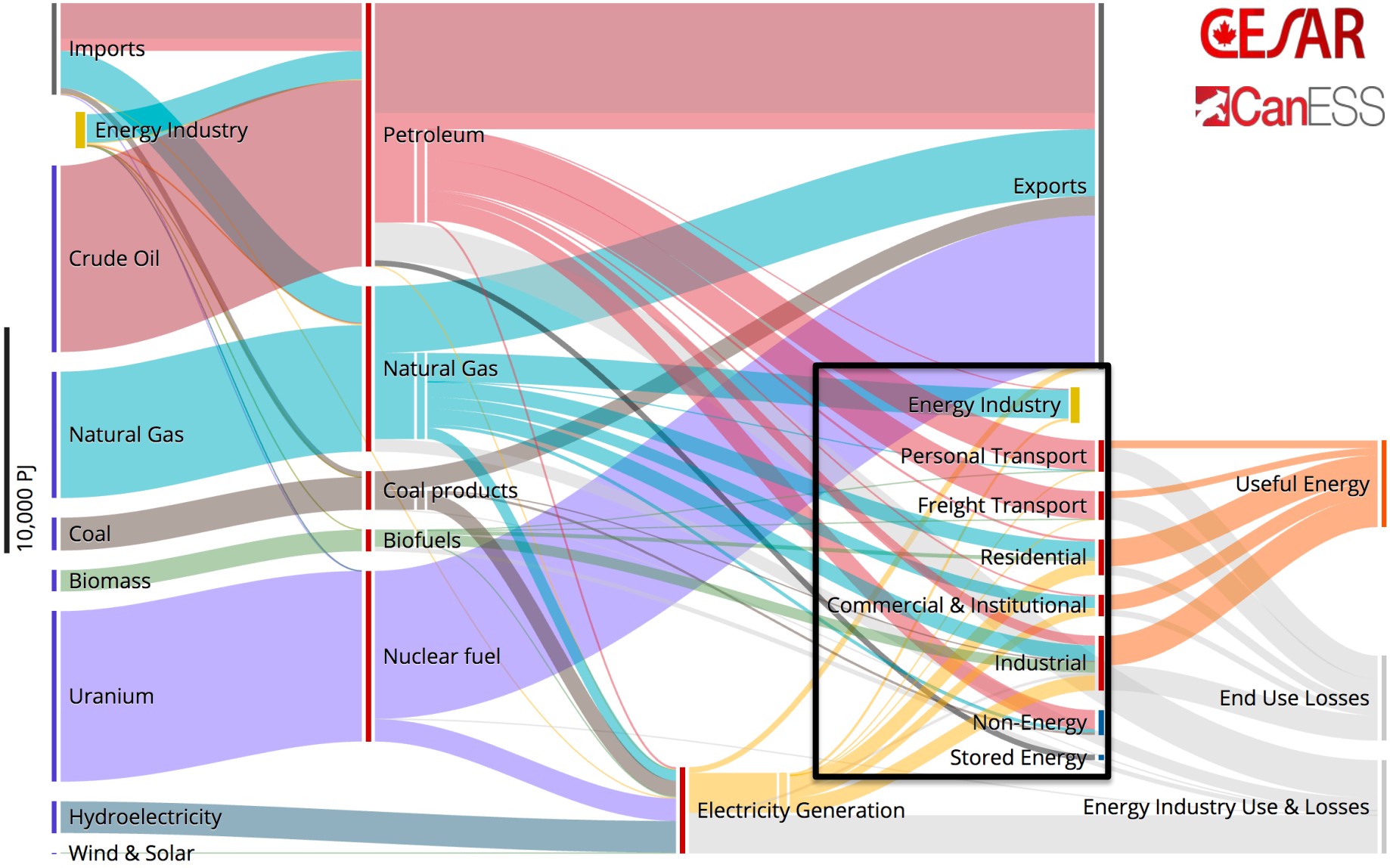
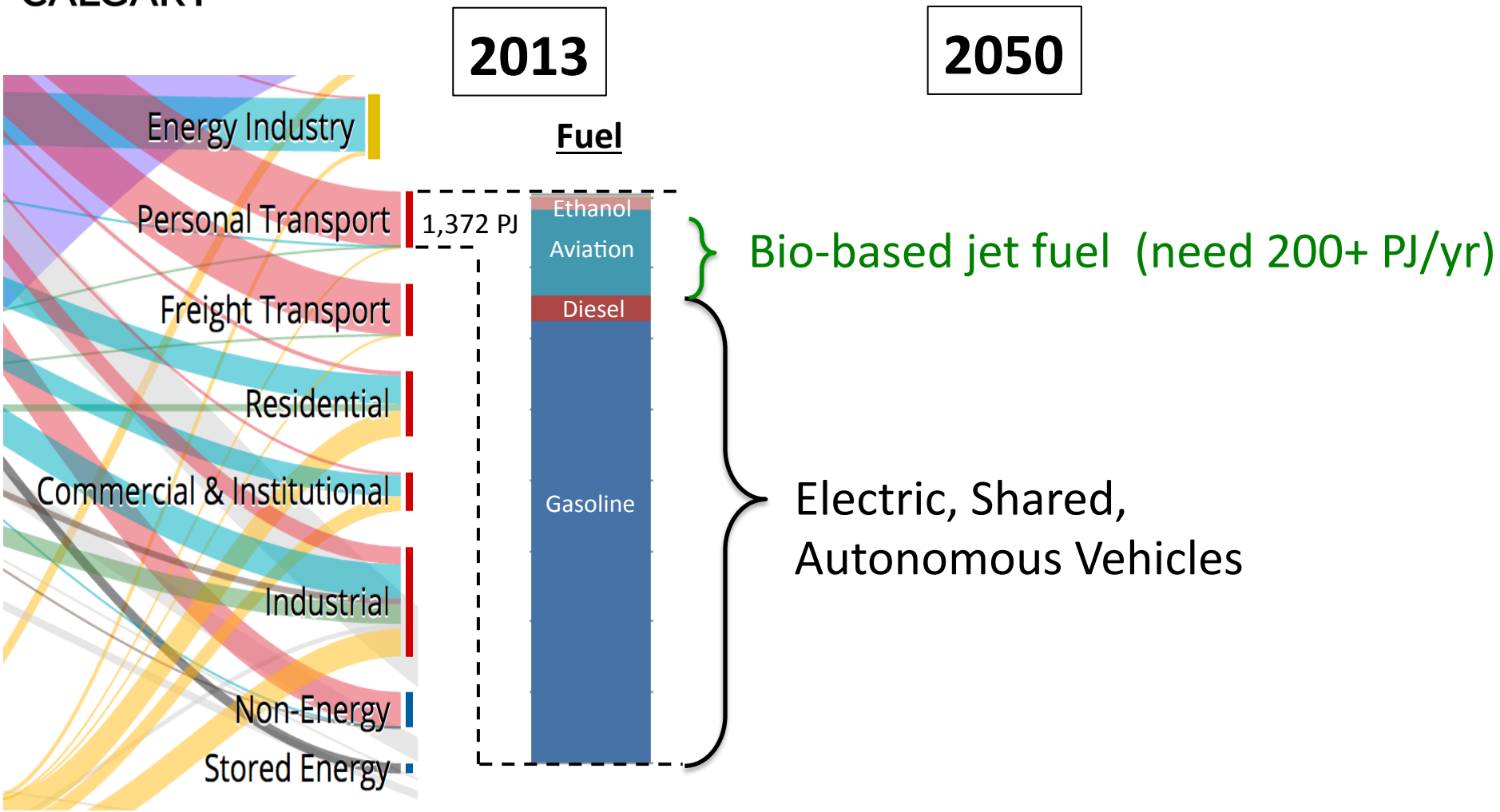
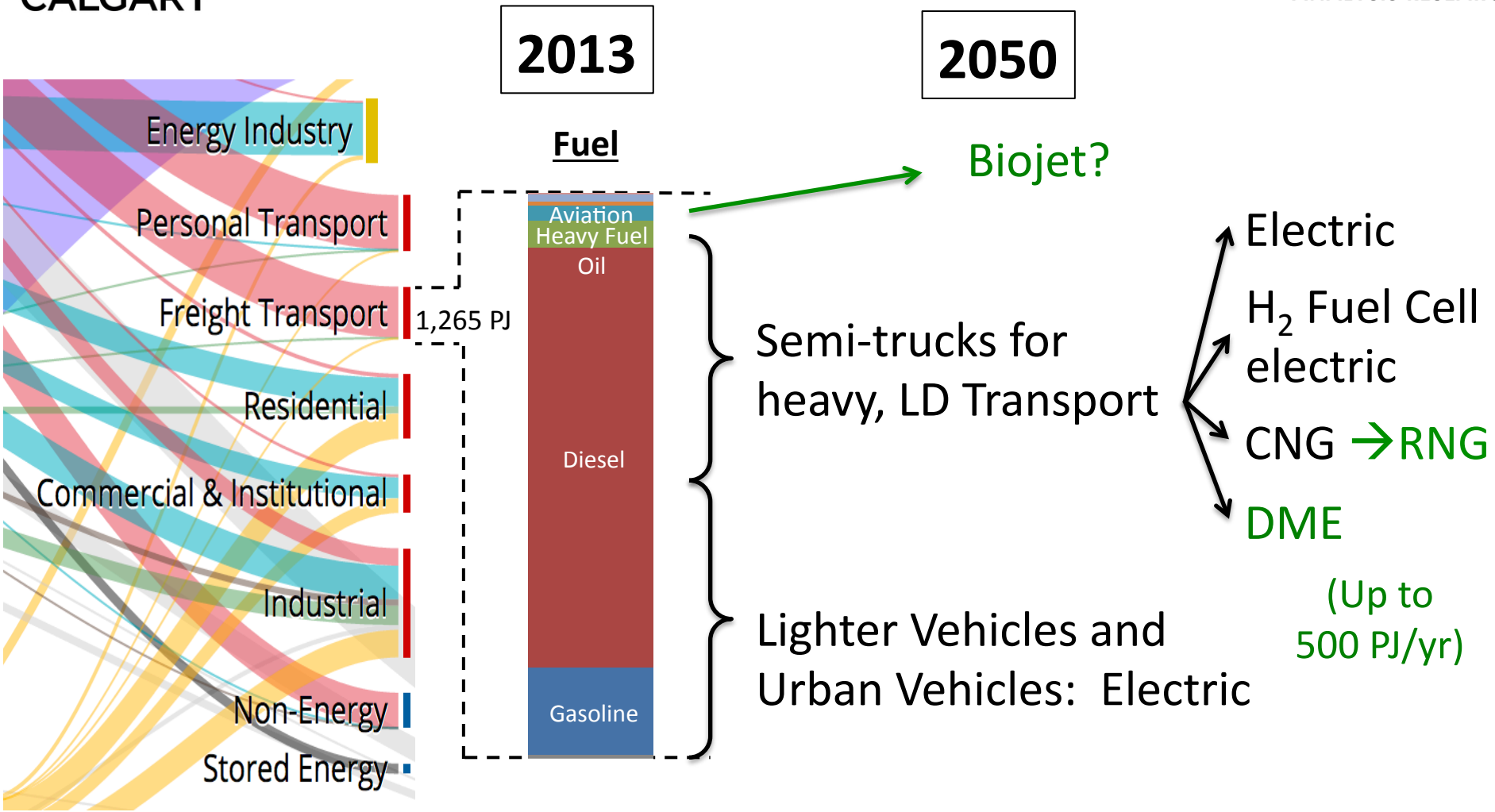


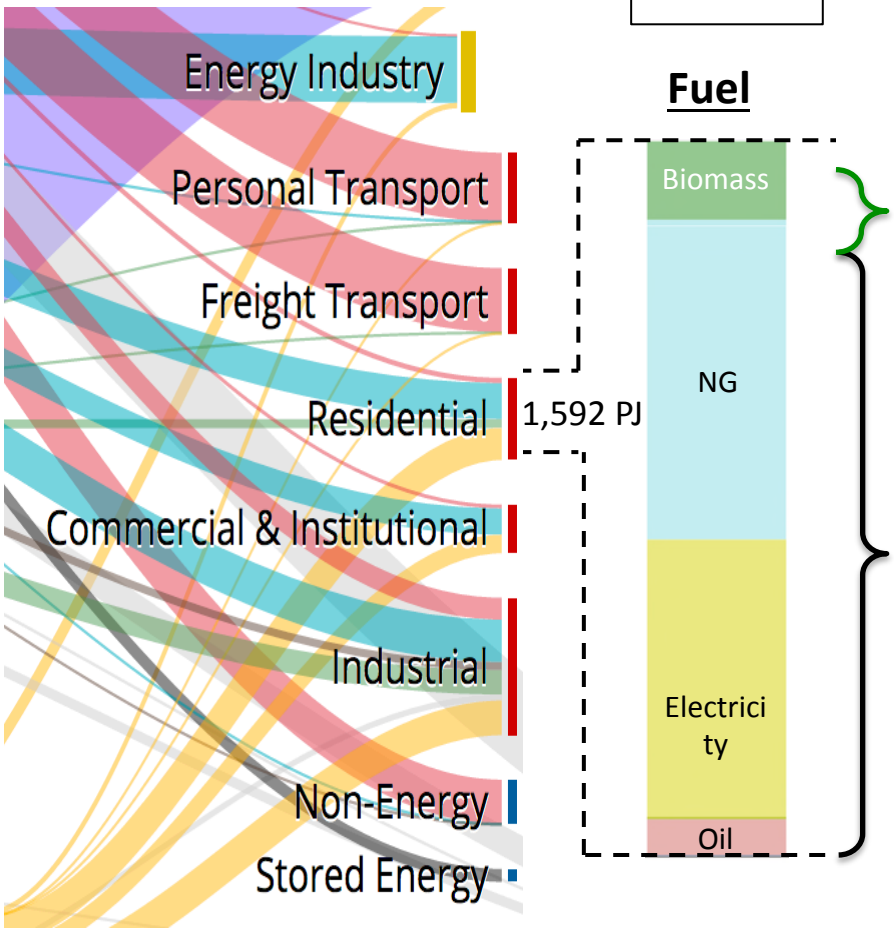
Personal Transportation



Freight Transportation



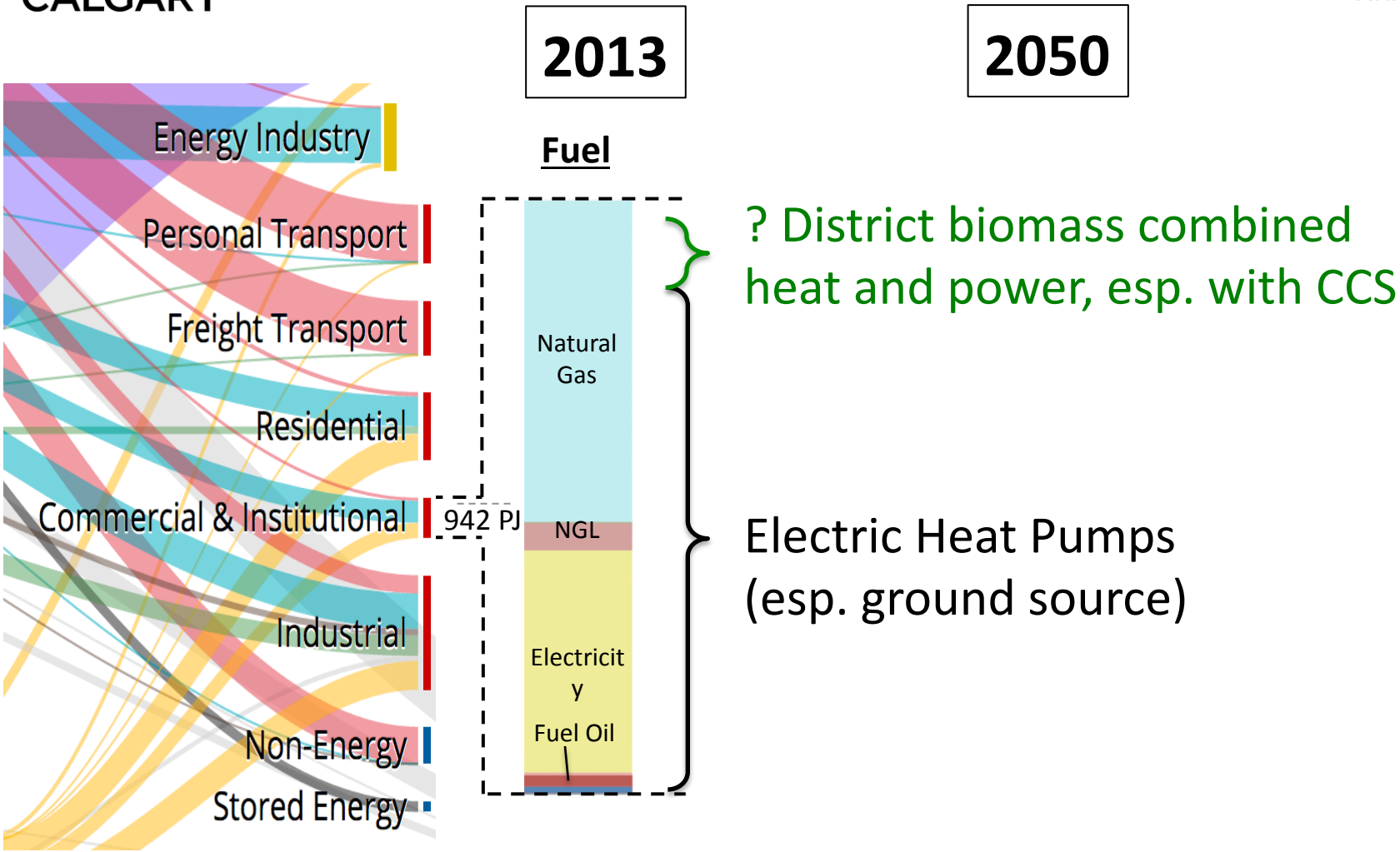
Residential Buildings (2013)



? District biomass combined heat and power, esp. with CCS

Electric Heat Pumps

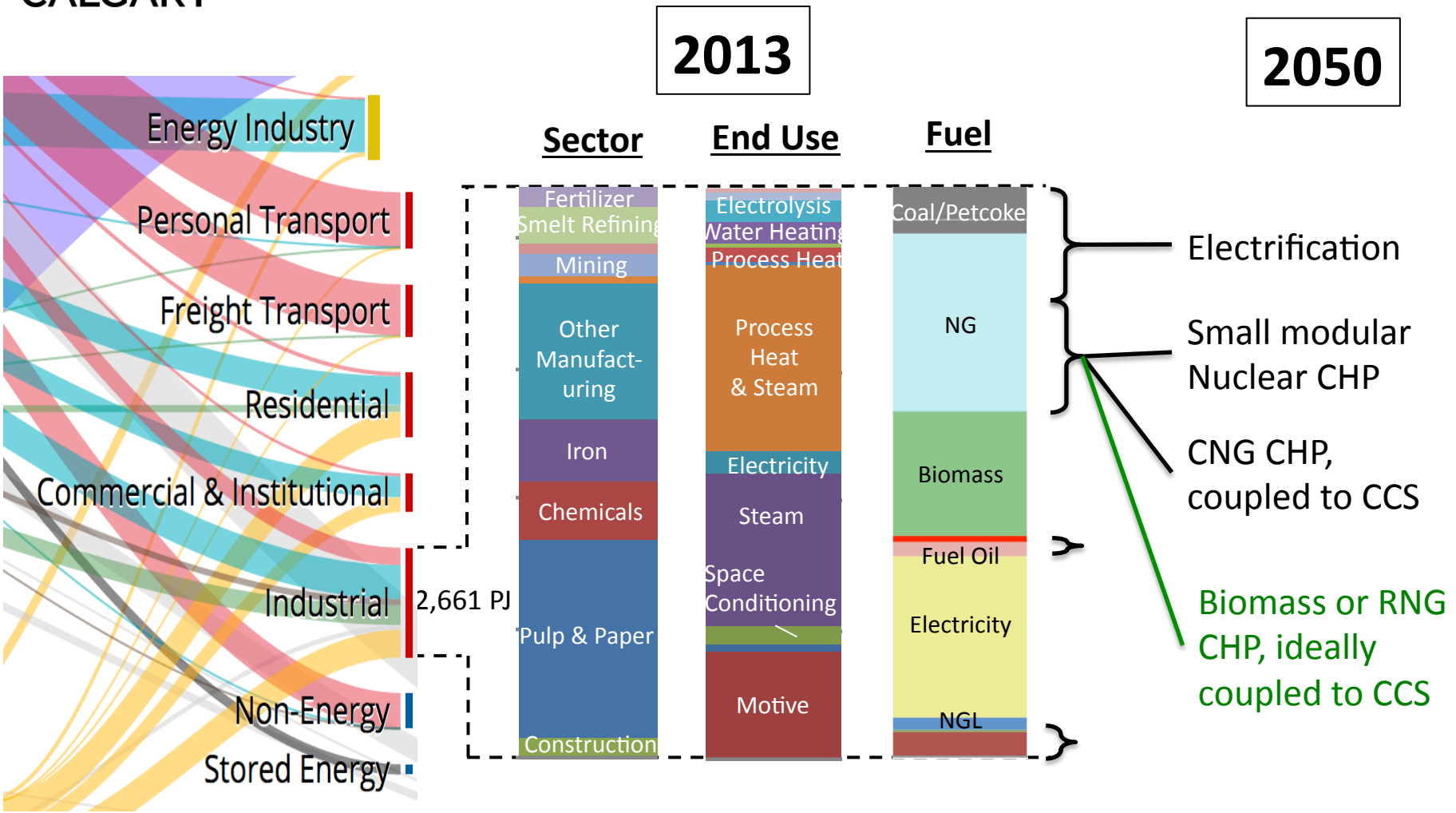
Commercial & Instit. Bldgs



? District biomass combined heat and power, esp. with CCS

Electric Heat Pumps (esp. ground source)

Energy Using Industries



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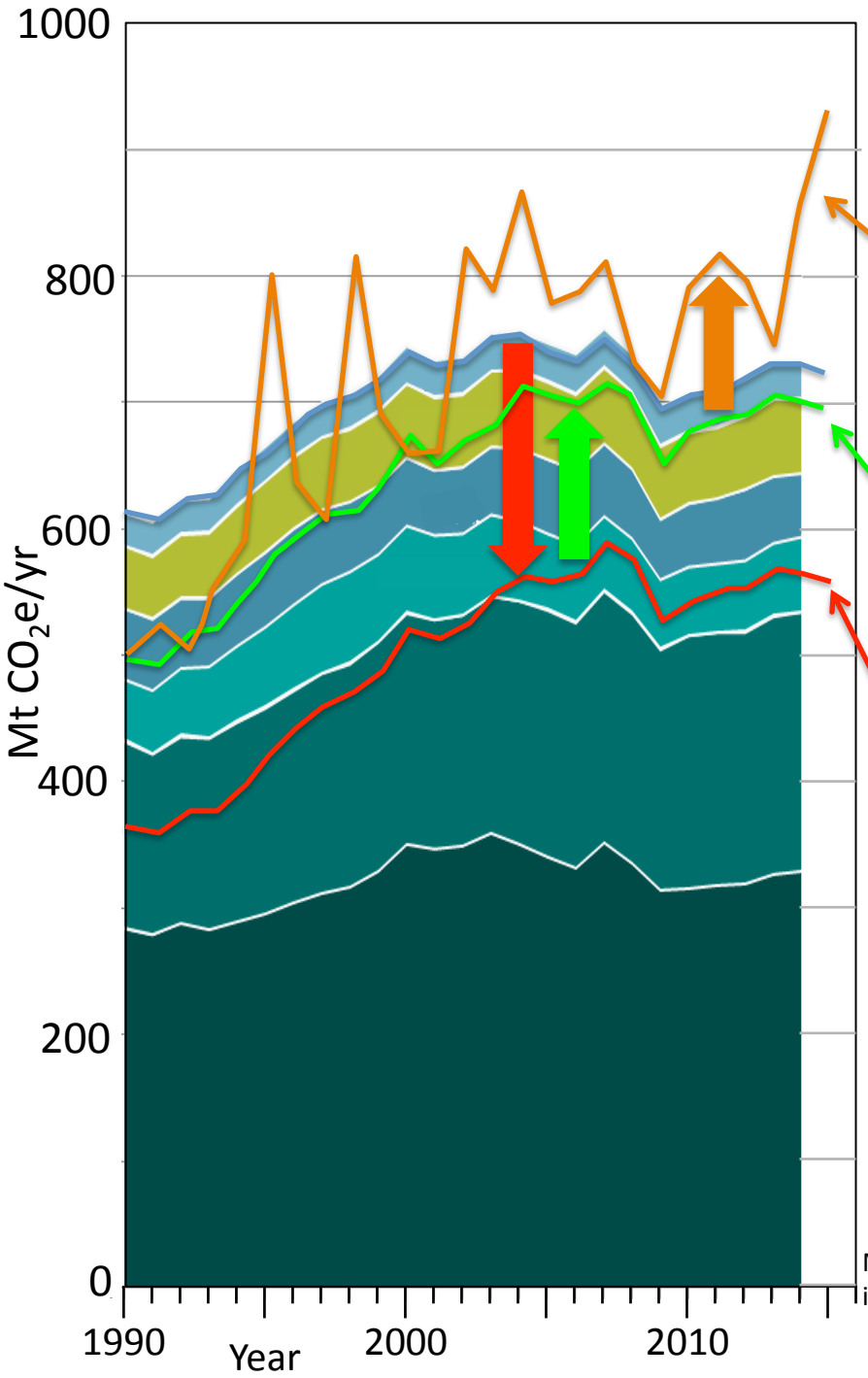
The Systems Challenge

What does the Atmosphere notice?

If forest biomass is left in forest:	Versus	*If forest biomass removed to make biofuels:*

For a vibrant forest bioenergy sector in the future, the systems level questions must be addressed now.

Adding the Forestry Factor



+ Emissions from Large Forest Fires (not human caused)

+ Emissions from Canada's Harvested Wood Products

Human Impact on Forest Land Remaining Forest Land (FLFL)

Modified from ECCC 2016 and 2017 National Inventory Reports, including values provided for LULUCF in the 2017 NIR

Conclusions

1. Canada has significant Feedstock resources
2. The 2050 opportunities for bioenergy/ biofuels:
   - Aviation Fuels
   - Heavy trucking fuels (lots of competition)
   - Combined Heat and Power (esp. with CCS)
3. Critical needs today:
   - Figure out feedstock logistics
   - Improve conversion efficiency, reduce costs
   - Address the Systems Challenge head on