Integrating Food and Fibre into Alberta's Energy Systems

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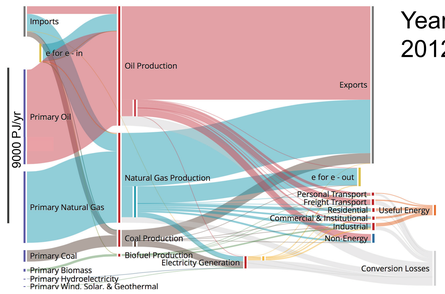
CESAR CANADIAN ENERGY SYSTEMS ANALYSIS RESEARCH

INTRODUCTION

Energy systems typically refer to only the production and use of **fuels and electricity** (see Alberta Sankeys, below)

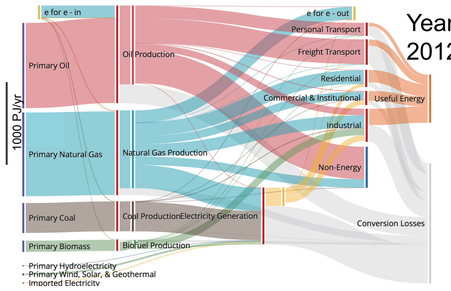
AB Energy Systems (Total)

Year: 2012



AB Energy Systems (Domestic)

Year: 2012



The flow of photosynthetically-derived energy **through food and fibre** should also be included.

We report here preliminary results of a study to integrate food and fibre into Alberta's energy systems.

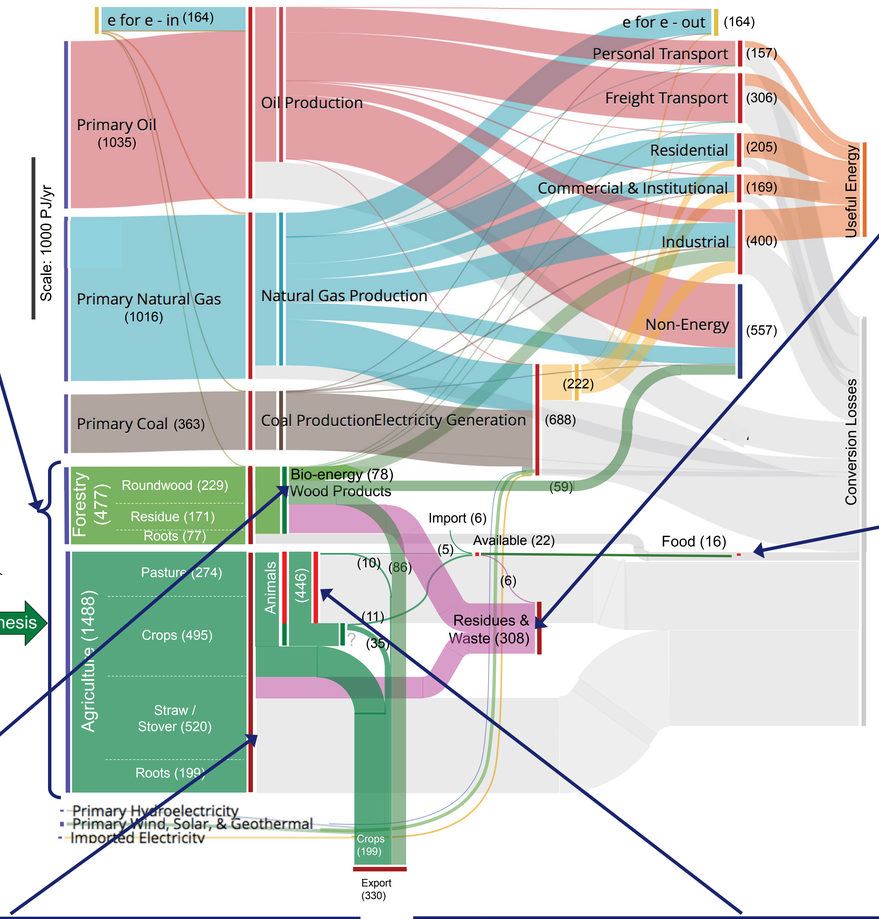
THE ENERGY SYSTEMS OF ALBERTA (DOMESTIC FUEL & ELECTRICITY PLUS FOOD AND FIBRE)

All values in Petajoules (PJ) per year for Alberta in 2012

1. The energy embedded each year in harvested trees and crops in Alberta (1965 PJ/yr) is similar to the primary energy supporting all oil and gas demand in the province (2051 PJ/yr).

2. Thanks to photo-synthesis, the biomass also holds CO_2 that was recently in the atmosphere.

3. Of the roundwood removed from the land (229 PJ/yr), 63% is converted into wood products (lumber, pulp & paper) and 34% used for energy.



Sun

CO_2 Photosynthesis

4. In agricultural systems, a significant portion of the straw / stover must be left on the land to preserve soil carbon (C) stocks, even though it eventually decays.

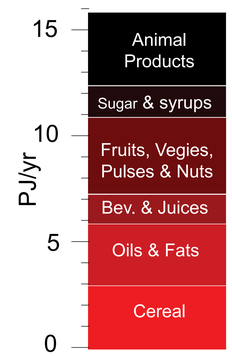
5. Animal production systems have very low efficiencies in converting pasture & crop production into energy in animal products.

6. The energy content of human food consumed in Alberta is:

- ❑ ~8% of residential energy demand
- ❑ ~4.4% of other personal energy demands (pers. transp. + residential)
- ❑ ~0.9% of all other domestic demand
- ❑ ~1-2% conversion efficiency from crops

7. Residues offer a major challenge (GHG emissions, especially methane) and opportunity (C-free energy or a carbon sink via biochar).

Energy sources in the Albertan diet:



METHODS

A wide range of provincial and federal government data resources were accessed [2,3,4] to obtain 2012 data for the production, disbursement, and consumption of agricultural and forest products.

The datasets were linked together and converted to flows of energy in petajoules (PJ) utilizing conversion factors obtained from the literature [5]. The results were then graphically represented within the fuel and electricity flows calculated from CanESS [6].

CONCLUSION

The annual flows of energy through the harvested trees and crops in Alberta is on a scale approximating that for the domestic use of oil and gas in the province. However, the losses and by-product streams created during conversion tend to be much larger in the bio-industries. Food production, for example is only ~2% efficient.

In a carbon-constrained world, managed biological systems offer not only a source of renewable energy, but, through conversion to biochar, a potential to permanently sequester atmospheric carbon into a form that could aid soil fertility.

Exploring ways to better utilize residual or waste streams from forestry and agriculture should be part of an Alberta energy strategy.

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