Renewability and Sustainability: Wise Use of Natural Resources

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The purpose is to develop a compelling picture that renewability is not equal to sustainability and sustainability is needed by our society, nation and planet. The Forest Products Industry (FPI) will be used as an example, but an equally compelling picture can be developed for almost any industry. The picture will illustrate that selecting inappropriate goals, drivers or policies can result in significant harm.

General Regulatory Environment

Figure 1 below illustrates the evolution of environmental goals and measurement systems:

Figure 1: Goals and Measurement Interaction[1]

	Type of Measurement System				
Type of Goal	**Direct Impact**	**Direct + Indirect Impact**	**Green House Gas impact**	**Life Cycle Analysis**	**NEXT?**
Green	1962				
Permit Compliance	1970's	N/A	N/A	N/A, until 2007	
Recyclable	1980's	1980's			
Low Carbon	2000's				
Renewable					
Sustainable				2007	
NEXT?					

*Direct means impact "inside the fence". Indirect impact means impact of imports is included.

There are 3 major observations:

First, goals and measurement systems are not static but have been evolving from the 1962 publication of "Silent Spring" to the life cycle analyses imposed on biofuel production in the 2007 Energy Independence and Security Act (EISA). This evolution has individual and industrial impact. One personal example is that many have had to replace their HVAC systems because its refrigerants are illegal and not available. One industrial example is that capital investments which need to operate 20 years for a payback have little future certainty.

Second, as illustrated by the dates, our nation is moving from the upper left to the lower right. While the direction is generally positive, there have been and will continue to be difficulties and unintended consequences. One unintended consequence is that many 1980's plants that are fully in compliance with row 3, column 2 requirements have identified significant energy and greenhouse reduction projects that are affordable and doable. However, many of these environmentally sound projects make the whole facility subject to new permit conditions. The vast majority of these environmentally friendly projects do not get implemented. That is an unintended and real consequence.

Third, we are not finished. There will be more rows and columns. More importantly there is a whole infrastructure built to the earlier standards that cannot be sacrificed. The real question is not being addressed. That is how much personal and industrial impact is really necessary and how much can we stand. The concern is that Congress is not equipped to address these questions.

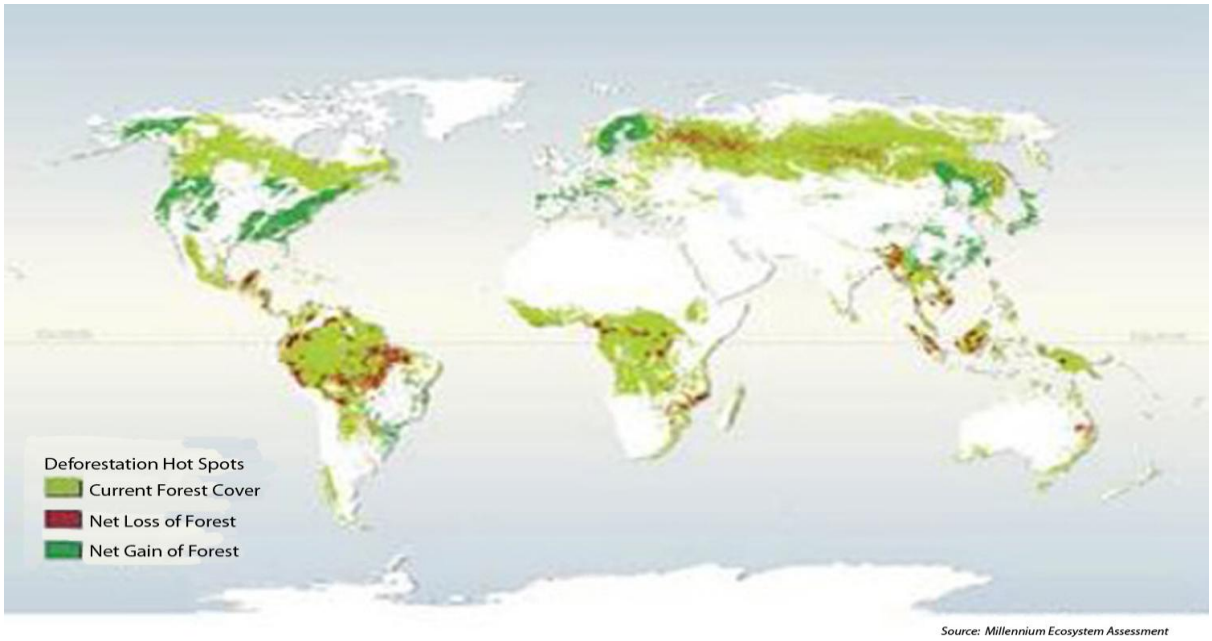
Pulp and Paper Wood Use in the U.S.

Let's turn to the concepts renewability and sustainability. A recognition of volume and efficiency are essential for defining these concepts.

Renewability is using materials that CAN BE replenished. In the FPI, wood is the primary raw material and it is definitely renewable. However, if we harvest indiscriminately, like has been done in other countries, wood will not be sustainable. In this situation, nations and industries dependent on wood suffer. Sustainability is using materials that ARE replenished. Therefore efficient use and recycling are important. For efficient energy, we will use British Thermal Units (BTUs) sold divided by BTUs purchased.

The FPI has a sustainable practice. In FPI lingo, the cut rate is lower than the growth rate. The U.S. Forest Service provides an inventory of standing timber board feet. These and other concepts push FPI from renewable to sustainable in wood use. Unfortunately, this sustainability is not well known by the public and by industries that use nonrenewable resources. The dark green in Figure 2 shows regions of the world where there is a net gain of forest resources. The red in Figure 2 indicates a net loss of forest resources. Light green is maintaining forest resources.

Figure 2: World Forest Inventory[2]



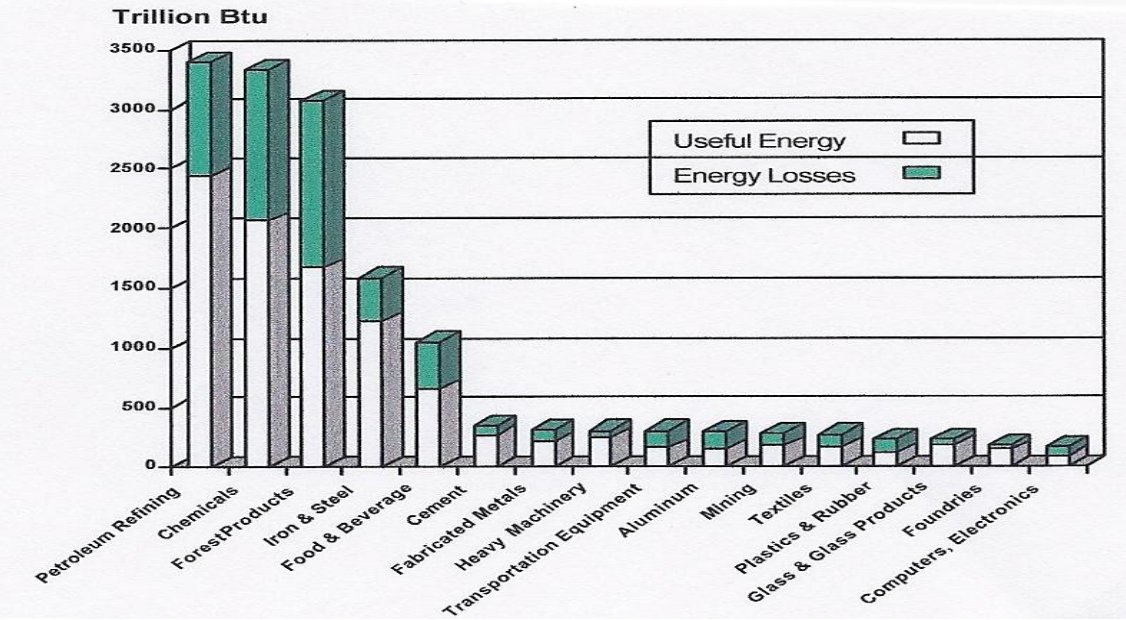
The picture we see is not what we would guess from everyday media coverage**.** The only major regions of the world where there is a gain of forest resource are the U.S., Scandinavian and Japan. Pulp and paper is a major industry in these countries. The pulp and paper industry is dependent on trees for its existence and nobody takes care of things like those who are dependent on them**. This makes the U.S. pulp and paper industry both renewable and sustainable for its major raw material**.

Energy Use

The reason to focus on energy second is that it is the second largest input to most pulp and paper mills.

The best energy savings will be achieved by focusing on the largest users. Figure 3 below shows energy use and energy loss for the 16 largest users excluding utilities which are not considered an industry by many who study energy.

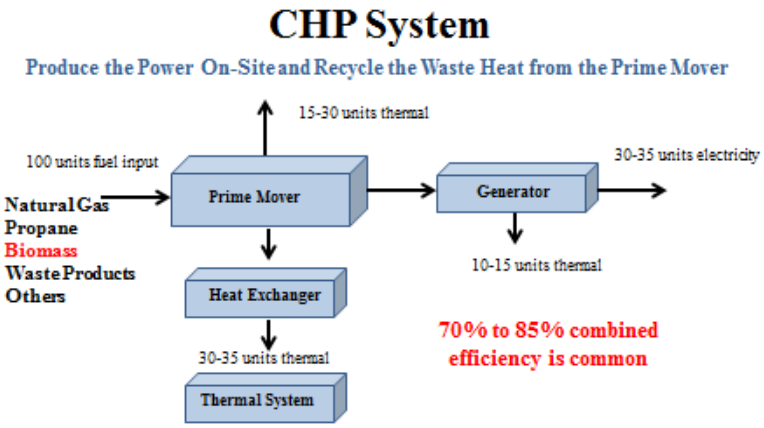
Figure 3: Energy Used and Lost for 16 Industries



Source: DOE Energy Loss Reduction and Recovery in Industrial Systems

The top 5 industries account for 80% of industrial energy use. FPI is third at nearly 3.0 Quads (quadrillion BTUs) and has a lower % loss than the other 4 large users. While this is good, there is another factor not shown. Pulp and paper is UNIQUE in that it self-produces 65% of its total energy need or about 1.4 Quads.[4] No other major industry produces its own heat and power. More importantly, this production is from renewable and sustainable sources. Black liquor contains the lignin from the tree and is burned in a chemical recovery furnace. Bark removed from logs and some mill residue is burned in a solid fuel boiler. The high pressure steam generated is passed through a step down steam turbine to produce electricity. The output electricity, steam and hot water are typically used in the mill processes. This combined heat and power system has thermal efficiencies which exceed 75%. Figure 4 below is a DOE representation about how Combined Heat and Power (CHP) work.

Figure 4: CHP System[5]



In pulp and paper (and other industries), spent steam and hot water from the steam turbine are use in the mill process, which maximizes the energy use. This high efficiency helps to make the process both renewable and sustainable. This fits large facilities well but the volume of steam for small facilities presents economic hurdles.

Now consider what happens when legislation and public pressure force the use of wood toward things like the production of power supplied to the grid from standalone facilities. Figure 5 shows typical electric production efficiencies for conventional standalone electric production facilities which represent 99% of those in the U.S.

Figure 5: Conventional Electric Generating System[6]

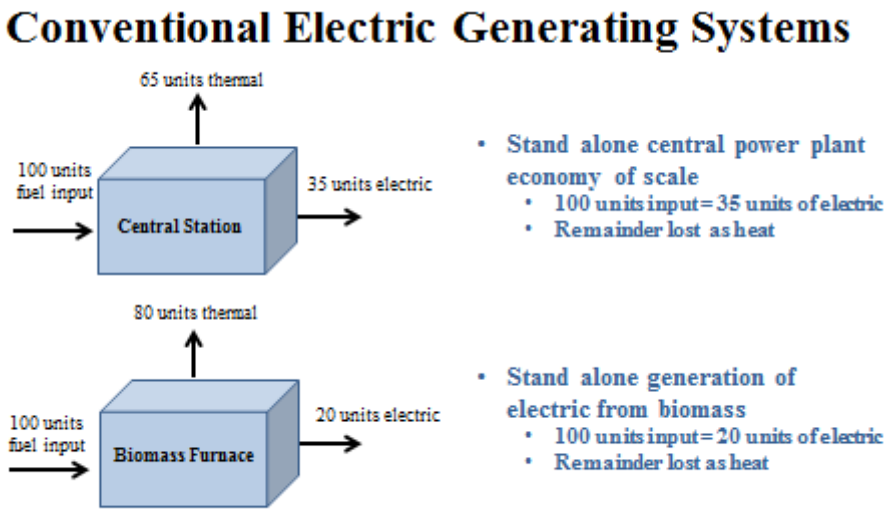
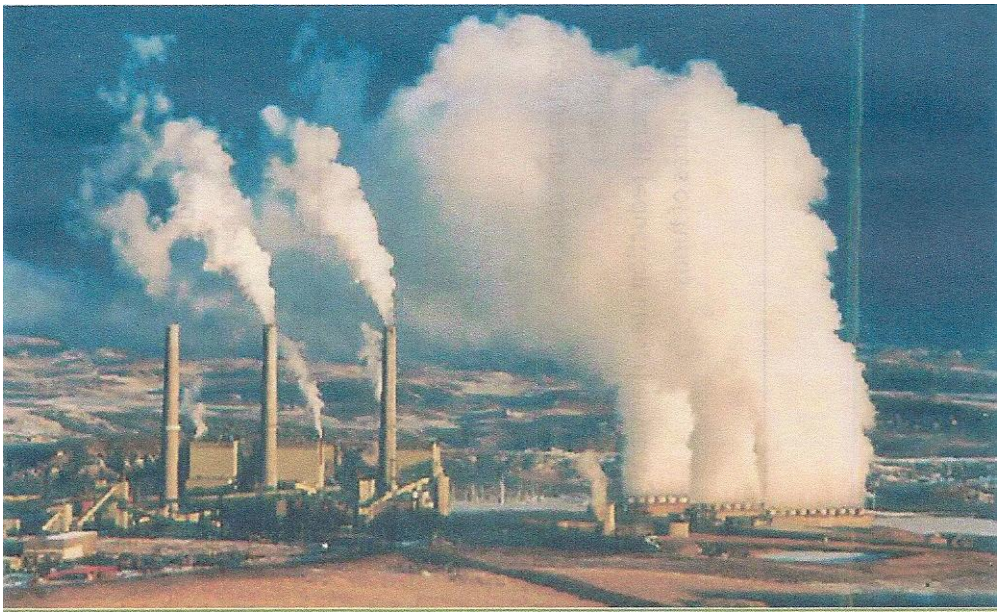


Figure 5 should raise many questions including the following two questions: 1) are you sure electric production in the U.S. is at 35% efficiency? and, 2) why is electrical production with biomass only 20%?

The first answer is absolutely. DOE tracks this number and it has averaged 34% for decades. Now, the next question may be what happens to the other 65% of the input BTUs. Studying Figure 6 provides a pictorial answer.

Figure 6: Photo of a Utility[7]



The large emission cloud to the right is water vapor from the cooling towers associated with the utility. The steam from a pass through steam turbine goes to a very inefficient condensing turbine, which produces a small amount of electricity while stream is condensed to hot water. Much of the hot water goes to cooling towers before release into the receiving stream. This is sad for a nation which imports vast quantities of energy.

Now, why does the use of biomass make the efficiency so much lower? There are many reasons. First, woody biomass typically contains 50% moisture which has to be evaporated. Second, the wood burns at a lower temperature which produces lower steam pressure. Third, lower pressure steam turbines have lower efficiency.

The key question becomes: Is 20% efficiency a sustainable practice? So far, no one has been willing to develop a position that it is a sustainable practice. Yet many states have renewable power standards which allow or encourage biomass to be included in the mix. Utilities incurring increased cost for this renewable capacity, which is required for compliance, are allowed to petition their Utility Commission to add these costs to the rate base. This inefficient use of wood hurts national sustainability and disrupts the wood market because the utilities are less concerned about controlling passed through cost.

The story can and frequently does get even uglier when jobs are considered. If renewable power legislation disrupts a market in a way that causes wood to be diverted to boilers versus factories jobs are lost. This is because it takes fewer jobs to run a boiler than run a factory turning the same amount of wood into higher value added products. So while a few jobs are created, more

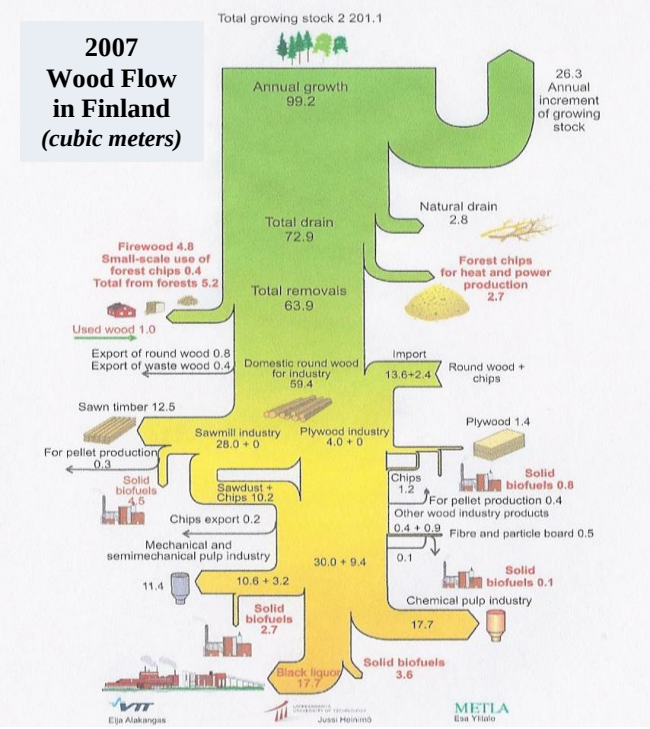
jobs are lost. The numbers can be staggering and will be illustrated in the next presentation. This is not a criticism of the utilities. It is a criticism about U.S. regulatory practices. One example is that there is a practice of not taking testimony from impacted industry because it will be self-serving. Yet few legislators and agency personnel know how industries work. That is a major cause of job loss in the U.S. and the allowance of unintended consequences.

The Federal government almost went down this same pathway when a renewable power standard was narrowly removed from 2007 EISA. Only Massachusetts with the famous Manoment Study has put up significant resistance and not entirely with the soundest reasoning. The Manoment Study focused on carbon emissions and backed into sustainability by making the assumption that there was no wood waste available in the study area and that none would be available in the study period. While this may have been true of the study area it is not generally true in the U.S. Using carbon emissions as a surrogate for sustainability is not recommended. All of this supports the point that sustainability is the superior goal and that to get it right one must focus on the right policies and drivers.

Let's return to the use of wood. The Advisory Council on Energy for the National Conference of State Legislators requested a presentation. Their fundamental question was prefaced with the recognition that when we consider renewable energy legislation there is usually no debate about solar, wind, or even geothermal. Why then is there always controversy about biomass? The short answer is there is little competition for sun, wind and geothermal but there is significant competition for wood. Also, the focus has been on an inappropriate policy of renewability not sustainability.

The 2007 wood flow in Finland was documented and put into a complex but understandable graphic shown in Figure 7.

Figure 7: 2007 Wood Flow in Finland (cubic Meters)[8]



Maps for the U.S. would look similar, except that there would be additional waste in the form of forest slash. It is this waste that some are seeking for biofuel production; so, over time the U.S. forest slash will also be used. In Finland and other countries almost the entire harvest is already used. The major point is that this is a complex market in which the waste from one user becomes the raw material for another user. As expected, in this diagram the wood is used for its highest value and the highest value generally creates the most jobs. Another factor is that the use is seasonal and harvesting changes daily based on demand and weather. Rain in the south and thaws in the north make certain tracks of wood not harvestable for days or weeks. Harvesting also changes by season as homebuilding is lower in the winter. Harvesting also changes over time as new companies are formed and some older companies close. However, policies without industry specific information tend to be static and not responsive to short-term, mid-term or even long-term market fluctuations.

The major conclusions are few:

1. The pulp and paper industry is sustainable in its use of the major raw material and more sustainable than any other major industry in energy.
2. Over time the pulp and paper industry can be sustainable in energy, even generating excess energy.
3. The nation will derive benefit from a focus on sustainability and real drivers.
4. The nation can be harmed from a focus on renewability and surrogate measures.
5. The nation should value testimony from industries which are to be regulated.
6. The nation should clearly understand the value chain to be regulated to avoid marked disruptions and avoid unwanted consequences.

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[1] "Environmental Policy Uncertainty", presented by B.A. Thorp at *PaperCon*, Atlanta, GA, 2011

[2] "Meeting National Goals: Pulp and Paper Industry – A Major Partner", *Biofuels Digest*, November 12, 2010, Harry Seamans, B. A. Thorp and Masood Akhtar.
[3] "Energy Loss Reduction and Recovery in Industrial Energy Systems", prepared for DOE by Energetics, circa 2004
[4] Pulp and paper represents 75 % of FPI or about 2.25 Quads. Of this 2.25 Quads, pulp and paper self-generates 65% or 1.4 Quads.
[5] CHP and District Energy Overview, presented by John Cuttica, BTEC Webinar May 25, 2011.
[6] Ditto, some updating from other DOE sources
[7] Ditto
[8] "Sugar Platforms in the Biorefinery", presented by Niklas Von Weyman, *3rd Nordic Wood Biorefinery Conference*, Stockholm Sweden, March 2011