

23-2220-RULE
23-2221-INV

2/2/2024

Technical Advisory Group Members,

Per federal policy, the GREET model published by the Argonne National Lab treats wood combustion as “carbon-neutral,” and does not count CO₂ emissions from the combustion of wood. The question, “is burning woody biomass carbon neutral?” is both an environmental question and a policy question. At the national level, moderate republican senator Susan Collins annually requires a statement that burning woody biomass is carbon-neutral be inserted into any budget package in exchange for her vote.

2016: <https://www.collins.senate.gov/newsroom/senators-collins-klobuchar-king-biomass-amendment-passes-senate>

2020: <https://www.latimes.com/opinion/story/2020-12-28/wood-burning-power-plants-clean-energy>

2022: <https://www.eenews.net/articles/carbon-neutral-scores-another-victory-in-omnibus/>

2023: <https://www.collins.senate.gov/newsroom/bill-to-fund-key-interior-and-environmental-programs-in-maine-clears-appropriations-committee>

You find this language on page 922 of the 2023 Senate Appropriations Budget Amendment:
(<https://www.appropriations.senate.gov/imo/media/doc/JRQ121922.PDF>)

Policies Relating to Biomass Energy

SEC. 432. To support the key role that forests in the United States can play in addressing the energy needs of the United States, the Secretary of Energy, the Secretary of Agriculture, and the Administrator of the Environmental Protection Agency shall, consistent with their missions, jointly—

- (1) ensure that Federal policy relating to forest bioenergy—
 - (A) is consistent across all Federal departments and agencies; and
 - (B) recognizes the full benefits of the use of forest biomass for energy, conservation, and responsible forest management; and
- (2) establish clear and simple policies for the use of forest biomass as an energy solution, including policies that—
 - (A) **reflect the carbon neutrality of forest bioenergy and recognize biomass as a renewable energy source**, provided the use of forest biomass for energy production does not cause conversion of forests to non-forest use;
 - (B) encourage private investment through out the forest biomass supply chain, including in—
 - (i) working forests;
 - (ii) harvesting operations;
 - (iii) forest improvement operations;
 - (iv) forest bioenergy production;
 - (v) wood products manufacturing; or
 - (vi) paper manufacturing;
 - (C) encourage forest management to improve forest health; and
 - (D) recognize State initiatives to produce and use forest biomass.

In 2018, climate crisis denier and Trump EPA director Scott Pruitt declared burning woody biomass carbon-neutral:

[Sierra Club on Pruitt on Biomass](#)

[NRDC on Pruitt on Biomass](#)

[Cliamte News on Pruitt on Biomass](#)

[Scientific American on Pruitt and Congress on Biomass](#)

As these articles make clear, while the politicians are declaring the burning of wood carbon neutral, the climate scientists are advising that burning wood adds CO₂ to the atmosphere. This conflict between the policy and the science led the EPA to issue its Biomass Policy Statement in 2018, found here: [EPA Biomass Policy Statement](#). The policy statement recognizes that executive orders and congressional directives have forced it to claim that burning wood is carbon-neutral despite the science:

To proactively address congressional directives and stakeholder concerns specific to the use of forest biomass for energy, EPA's policy in forthcoming regulatory actions will be to treat biogenic CO₂ emissions resulting from the combustion of biomass from managed forests at stationary sources for energy production as carbon neutral....

This statement of agency policy is not a scientific determination and does not revise or amend any scientific determinations that EPA has previously made....

Beginning in 2010, in response to stakeholder comments, EPA sought to advance the technical understanding for assessing the net biogenic CO₂ emissions associated with the use of biomass at stationary sources. In 2011, as part of this process to advance our technical understanding, EPA submitted for peer review with the EPA Science Advisory Board (SAB) a draft technical report presenting considerations for evaluating the biogenic CO₂ emissions associated with biomass use for energy at stationary sources (2011 Draft Framework). The SAB peer review of the 2011 Draft Framework found that it is not scientifically valid to assume that all biogenic feedstocks are carbon neutral, but rather that the net biogenic carbon profile related to the use of biomass feedstocks depends upon factors related to feedstock characteristics, production and consumption, and alternative uses....

The SAB further acknowledged that accounting for biogenic CO₂ emissions associated with stationary sources involves both scientific and policy considerations, including the policy context in which the accounting is applied....

The Argonne National Lab follows federal policy, and thus does not count the emissions from wood-combustion. The GREET model follows this policy, counting only upstream CO₂ emissions from logging activity. I don't believe the ePUC site allows for .xls documents so I've attached a .pdf export of the bioelectric tab from the 2023 GREET .xls spreadsheet. Note that CO₂ is not among the tracked greenhouse gases.

Here in Vermont, the Scott administration falls squarely in the Scott Pruitt camp. It continues to be the policy of the Vermont Agency of Natural Resources (ANR) to consider burning wood carbon-neutral, despite clear evidence to the contrary. In ANR's [Vermont Greenhouse Gas Emissions Inventory and Forecast Methodologies](#) ANR makes the following erroneous statement:

Carbon dioxide from electricity generated through biomass combustion is not included because the CO₂ is of biogenic origin, but CH₄ and N₂O emissions are included in the totals. States in the region differ on this accounting practice, however, it is consistent with IPCC inventory guidelines for the treatment of biogenic CO₂.

Again, ANR's statement about IPCC guidelines is incorrect; IPCC guidelines do not claim that biomass combustion should not be included in inventories. ANR Secretary Julie Moore admitted this in an email to me dated May 16, 2023, stating, "You are correct that the IPCC guidelines do not state that biogenic CO₂ shouldn't be included greenhouse gas inventories." Sec. Moore then goes on to incorrectly claim that IPCC guidelines state "that the CO₂ released [from wood-combustion] will eventually be re-sequestered through the regrowth of the biogenic material." IPCC guidelines make no such claim.

In Act 170 of 2012, "An act relating to the Vermont energy act of 2012," the Vermont legislature mandated that ANR draft rules for greenhouse gas accounting by September 1, 2013. Ten years later, Secretary Moore acknowledged that ANR has still not drafted these rules. By fiat only is ANR making the decision not to count emissions from wood, and is doing so without proper rule making or oversight. Further, ANR has directed consultants it hires to exclude the emissions from wood-burning. The recent 2023 Vermont Energy Report published by the Department of Public Service (DPS) demonstrates this. Writing about the *Cadmus/Energy Futures Group Pathways Analysis*, the DPS report advises that ANR guided EFG to consider wood-burning carbon neutral:

"For example, advanced wood heat is identified as being the most cost-effective measure through 2030, with reductions in vehicle miles traveled (VMT) being the most expensive. It must be noted that, like any modeling, the analysis here is directly related to the inputs. For example, emissions from biomass were, consistent with Agency of Natural Resources guidance,¹¹ assumed to be zero...." (11, [2023 Vermont Energy Report, DPS](#))

In order to actually reduce greenhouse gas emissions, the TAG must provide for accurate emission factors for all fuel types, including and especially wood. The emission factors from the EPA website is a good place to start, though the EPA only provides factors on a 100-year global warming potential (GWP) basis. Using emission factors with a 20-year GWP would be even better.

District Energy Systems (DES) that use geothermal heating and cooling systems can play an important role in reducing thermal related greenhouse gases. However, not all DES are created equal. Vermont Gas (VGS) and Burlington Electric (BED) are proposing a DES that relies on the highly inefficient McNeil wood-burning generator to supply heat the University Medical Center (UVMC). They've modeled their system using GREET. I've attached two slides from a BED and VGS presentation of their DES proposal to the Burlington City Council. They claim that the proposed District Energy System will reduce CO₂ emissions by about 13,000 tons annually. They claim this because VGS and BED also claim that burning wood is carbon-neutral. Climate scientists have thoroughly debunked this belief. Even so, at Vermont's current rate of deforestation, even by the accounting methods used by VGS and BED, **Vermont forests will be net carbon emitters in only 25 years** if the Vermont legislature does not take action. Using the MMBTU amounts on the first slide and the carbon emissions factors found in the EPA website: <https://www.epa.gov/climateleadership/ghg-emission-factors-hub>, we find that the proposed VGS-BED district energy system will actually *increase* CO₂ emissions by 6,778 tons annually.

Wood: 93.80kg CO₂ per mmBtu 93.8 X 190,000 MMBTU = 17,822,000 kg CO₂

Natural Gas: $53.06 \text{ kg CO}_2 \text{ per mmBtu} \times 220,000 \text{ MMBTU} = 11,673,200 \text{ kg CO}_2$

Net **increase** by switching to wood is **6,148,800 kg CO₂** per year
or **6,778 tons of CO₂ annually**.

It is no wonder why the VGS representative at the 2/2/2024 TAG meeting promoted the use of GREET: if you count the actual emissions, the DES is more polluting. GREET should not be used to model wood-combustion systems. If the TAG chooses to use the GREET model, TAG must also ensure that clear and significant, well documented and published changes are made to the emission factors for wood and other bio-fuels used in the GREET model.

Sincerely,

Pike Porter
Burlington, VT
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This document uses active hyperlinks. If a link is broken, please contact me and I'll supply the correct link.

Bio-Electricity Generation

Hon

1) Scenario Control and Key Input Parameters

Forest resource extraction

Residues collection energy use	2
Source of wood chips	1
Source of wood pellets	1
Properties of pulplogs (for transportation calculation)	2

Assumptions on emissions

Emission factors for bio-power plant	1
GWP for black carbon (BC)	1

Allocation method (lumber mill operation)

	wood chips
Sawing process	3
Planning process	3

2) Key Input Parameters for Electricity Generation Mixes, Combustion Technology

2.1) Regional Combustion Technology Shares and Power Plant Energy Conversion Efficiency

Fuel	
Combustion Technology	
Region	U.S.
Efficiency	21.7%
Technology Share	100.0%
Emissions (g/kWh)	
VOC	0.032
CO	1.182
NOx	0.679
PM10	0.073
PM2.5	0.069
SOx	0.122
BC	0.010
OC	0.022
CH4	0.113
N2O	0.060

2.2) Urban Emission Share for Stationary Applications

1.30%

2.3) Electric Transmission and Distribution Loss

Region	U.S.
T&D Loss factor	4.9%

2.4) Electricity mix and T&D Loss for each state if NERC level data option is selected

State	WA
NERC	WECC
T&D Loss	Western

CCS Parameters

Percentage of CO2 capture	95%
Ash content of biomass	0.48%

Energy requirements for CO2 capture and transportation

	Biomass fired power pl
CO2 transportation distance (miles)	200
Electricity for CO2 capture (MJ/MT-CO2)	1060.03
Electricity for CO2 compression at the CO2 source (MJ/MT-CO2)	370.99
Electricity for CO2 transportation (booster pumps) (MJ/MT-CO2)	8.20

Energy Sources for CO2 capture & transportation

Electricity Sources for CO2 capture	1
Electricity Sources for CO2 transportation	5

3) Key Input Parameters for Biomass Properties, Share, and Logistics

3.1) Biomass Properties for roundwood

	Pine
Carbon Content	52.0%
Sulfur Content	0.1%
Lower Heating Value (btu/dry bone ton)	16,646,000
Higher heating value (btu/dry bone ton)	17,774,000
Specific gravity (bdt/m3), oven dry)	0.45
Moisture Content	45%
N ₂ O emission factor (fertilizer)	1.374%

3.1.1) Moisture content for logging residues and mill residues

	WA
SW LogRes	30%
HW LogRes	30%
SW Mill residues	31.5%
HW Mill residues	31.5%
SW Mill chips	46.2%
Pellets	8%

3.2) Regional Feedstock Types for Power Plants

Representative forest types by state	WA
Softwood (SW) species for each state (primary)	Douglas-Fir
Softwood (SW) species for each state (secondary, optional)	
Hardwood (HW) species for each state (primary)	Alder/Maple
Hardwood (HW) species for each state (secondary, optional)	
Wood pellets (HW or SW) for each state	SW

Share of primary and secondary HW/SW species	WA
Share of Primary SW species	100%
Share of Secondary SW species	-
Share of Primary HW species	100%
Share of Secondary HW species	-

Weighted biomass properties for SW feedstock by state	WA
Carbon Content	52.0%
Sulfur Content	0.0%
Lower Heating Value (btu/dry bone ton)	16,742,000
Higher heating value (btu/dry bone ton)	17,090,000
User defined gravity (LURA by default)	0.42
User defined MC (LURA by default)	36%
Specific gravity (bdt/m3), oven dry) used in log calculation	0.42
Moisture Content (% , wet basis) used in log calculation	36%

Weighted biomass properties for HW feedstock by state	WA
Carbon Content	50.2%
Sulfur Content	0.0%
Lower Heating Value (btu/dry bone ton)	15,748,000
Higher heating value (btu/dry bone ton)	16,908,000
User defined gravity (LURA by default)	N/A
User defined MC (LURA by default)	0%
Specific gravity (bdt/m3), oven dry) used in log calculation	0.48
Moisture Content (% , wet basis) used in log calculation	45%

Share of biomass supply by weight (dry ton basis)	WA
SW Logs	0.156
HW Logs	-
SW LogRes	-
HW LogRes	-
SW MillRes	0.789
HW MillRes	0.056
SW Mill Chips	-
Pellets	-

Energy content by feedstock by state (btu/ton)	WA
SW Logs	16,742,000
HW Logs	15,748,000
SW LogRes	16,742,000
HW LogRes	15,748,000
SW MillRes	16,742,000
HW MillRes	15,748,000
SW Mill Chips	16,742,000
Pellets	16,742,000

Share of energy source by feedstock by state	WA
SW Logs	0.156
HW Logs	-
SW LogRes	-
HW LogRes	-
SW MillRes	0.791
HW MillRes	0.052
SW Mill Chips	-
Pellets	-

3.3) Forest Operation

3.3.1) Site preparation, planting, and stand management

Feedstock type	
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Species	PNW
Rotation	66
Energy Use (per ha)	
BTU of Diesel	2,985,214
BTU of Gasoline	
BTU of Lubricant	
BTU of Jet Fuel	
BTU of Electricity	
Fertilizer Use (per ha)	
Grams of Nitrogen	37
Grams of P2O5	62
Grams of K2O	152
Grams of CaCO3	
Pesticide Use (per ha)	
Grams Herbicide	-
Grams Insecticide	-

3.3.2) Harvesting (from site to landing)

Feedstock type	
	Mixed_Res
Species	
Bioenergy Removals (dry ton per ha)	
Dry Tons of Dedicated Harvest	
Dry Tons of Harvest Residues	
Dry Tons of Commercial Thinnings	
Energy Use (per dry ton)	
BTU of Diesel	33,831
BTU of Gasoline	
BTU of Lubricant	970
BTU of Jet Fuel	
BTU of Electricity	

Harvest energy assumptions for each state	WA
Residues	Douglas-Fir_Res
Roundwood	PNW_Costal

3.4) Feedstock processing and handling (excl. transportation)

	Forest Residue Processing
	Grinding & Loading
Energy Use (per dry ton, except as noted)	

BTU of Diesel	131,266
BTU of Gasoline	
BTU of Lubricants	2,358
BTU of Jet Fuel	
BTU of Electricity (grid)	
BTU of Liquefied petroleum gas (LPG)	
BTU of Natural Gas	
BTU of Biomass (woody fuel, waste)	
Process water at lumber mill (gallon/m3)	

3.4.1) Mass balance and economic value share at lumber mill

Allocation Method	
Products	PNW
sawn lumber, green	50.1%
chips, green	24.4%
sawdust, green	5.6%
hogfuel/wood fuel, green	13.8%
bark	6.0%

Allocation Method	
Products	PNW
Sawn lumber	88.7%
Chips	1.3%
Sawdust/shavings	10.1%

3.5) Feedstock transportation

3.5.1) Truck loading capacity

	Volume (m³)
Heavy Heavy-Duty Truck loading capacity	38

3.5.2) Cargo Payload By Transportation Mode and by Product Fuel Type: Tons

Fuel Transported	Pulp Logs
Heavy Heavy-Duty Truck	25

3.5.3) Fuel Economy and Resultant Energy Consumption of Heavy-Duty Trucks

	Fuel Economy: miles/diesel gallon
Trip from Product Origin to Destination	7.5
Trip from Product Destination Back to Origin	9.5

3.5.4) Hauling distance assumptions

Distance by feedstock by state (Miles, one-way)	WA
SW Logs	24.8
HW Logs	-
SW LogRes	-
HW LogRes	-
SW MillRes	23.6
HW MillRes	12.5
SW Mill Chips	-
Pellets	-

3.6) Assumptions on biomass loss during processing and transportation

	Feedstock processing
Loss factor	0%

	Forest management
	Site prepare, planting, and stand management
Diesel commercial boiler Diesel stationary engine Diesel turbine Diesel off-road equipment	100.00%
NG engine NG large turbine NG large industrial boiler NG small industrial boiler NG off-road equipment	
Biomass small industrial boiler Biomass large industrial boiler Biomass gasifier	
Processing urban emission share	0%

4) Calculations of Energy Consumption, Water Consumption, and Emissions for E

4.1) Forest operations (Btu,gram,gallon/ton) for roundwood production

	PNW_Costal
Energy Consumption: Btu/ton	
Total energy	30,547
Fossil fuels	30,392
Coal	216
Natural gas	3,147
Petroleum	27,029
Water consumption: gallons	1
Emissions: grams	
VOC	1.20
CO	5.45
NOx	11.65
PM10	0.82
PM2.5	0.80
SOx	0.14
BC	0.60
OC	0.17
CH4	2.88

N2O	0.06
CO2	2,341
Urban emissions:grams	
VOC	0.072
CO	0.049
NOx	0.075
PM10	0.013
PM2.5	0.011
SOx	0.027
BC	0.001
OC	0.002

4.2) Residue collection or roundwood harvest (Btu,gram,gallon/ton)

	PNW_Costal
Energy Consumption: Btu/ton	
Total energy	260,784
Fossil fuels	259,476
Coal	1,816
Natural gas	26,674
Petroleum	230,986
Water consumption: gallons	5
Emissions: grams	
VOC	10.27
CO	46.52
NOx	99.53
PM10	7.04
PM2.5	6.80
SOx	1.15
BC	5.09
OC	1.45
CH4	24.58
N2O	0.50
CO2	19,992.15
Urban emissions:grams	
VOC	0.612
CO	0.418
NOx	0.636
PM10	0.110
PM2.5	0.094
SOx	0.227
BC	0.012
OC	0.017

4.3) Feedstock processing (Btu,gram,gallon/ton)

Processes	Forest Residue Processing
Region	
Biomass loss factor	0%

	Grinding & Loading
Total energy	157,761
Fossil fuels	156,969
Coal	1,098
Natural gas	16,136
Petroleum	139,734
Water consumption: gallons	3
Emissions: grams	
VOC	6.22
CO	28.14
NOx	60.21
PM10	4.26
PM2.5	4.11
SOx	0.70
BC	3.08
OC	0.87
CH4	14.87
N2O	0.30
CO2	12,094
CO2 burned in biomass that is from atmosphere	0
Urban Emissions: grams	
VOC	0.370
CO	0.253
NOx	0.385
PM10	0.066
PM2.5	0.057
SOx	0.138
BC	0.007
OC	0.010

4.4) Feedstock transportation (Btu,gram,gallon/ton)

Feedstock	SW Pulp Logs
Transportation Mode	Truck
Urban Emission Share	5.0%
Biomass loss factor	0.0%
Distance (Miles, one-way)	24.8
Share of Fuel Type Used:	
Diesel	100%
Gasoline	
Natural Gas	
Biodiesel	
Renewable Diesel	
Hydrogen	
Electricity	

Energy Intensity: Btu/ton-mile	
Origin to Destination	1068
Back-Haul	848
Energy Consumption: Btu/ton	
Total energy	56,217
Fossil energy	55,935
Coal	391
Natural gas	5,750
Petroleum	49,794
Water consumption: gallons/mmBtu of fuel transported	1
Total Emissions: grams per ton transported	
VOC	0.680
CO	9.588
NOx	6.529
PM10	0.364
PM2.5	0.104
SOx	0.253
BC	0.010
OC	0.017
CH4	5.259
N2O	0.017
CO2	4315
Urban Emissions: grams per ton transported	
VOC	0.148
CO	0.540
NOx	0.420
PM10	0.039
PM2.5	0.023
SOx	0.050
BC	0.003
OC	0.004

4.5) Power Plant Emissions: in Grams per kWh of Electricity Available at Power Plant Gate

State	WA
Options for electricity generation emissions (US, NERC, User)	U.S.
Emissions: grams	
VOC	0.032
CO	1.182
NOx	0.679
PM10	0.073
PM2.5	0.069
SOx	0.122
BC	0.010
OC	0.022
CH4	0.113
N2O	0.060
CO2 (w/ C in VOC & CO)	1,629
CO2 burned in biomass that is from atmosphere	-1,632

4.6) Power Plant Emissions: Grams per kWh of Electricity Available at User Sites (wall out)

State	WA
Emissions: grams	Total
VOC	0.034
CO	1.243
NOx	0.714
PM10	0.077
PM2.5	0.072
SOx	0.128
BC	0.010
OC	0.024
CH4	0.119
N2O	0.063
CO2	-2

4.7) Power Plant Energy Use and Emissions: per mmBtu of Electricity Available at User Si

	WA
Energy Use: Btu	Total
Residual oil	
NG	
Coal	
Biomass	4,854,745
Nuclear	
Other energy sources	
Emissions: grams	
VOC	9.824
CO	364.205
NOx	209.152
PM10	22.624
PM2.5	21.220
SOx	37.613
BC	2.928
OC	6.918
CH4	34.807
N2O	18.528
CO2	-699

4.8) Energy source by woody feedstock (lbs per mmBtu)

Production inputs (lbs per mmBtu)	WA
SW Logs	90.8
HW Logs	-
SW LogRes	-
HW LogRes	-
SW Sawdust and Shavings	458.8
HW Sawdust and Shavings	32.3
SW Chips	-
Pellets	-

Biogenic CO2 for CCS (lbs per mmBtu) from electricity production	feedstock type
SW Logs	SW
HW Logs	HW

SW LogRes	SW
HW LogRes	HW
SW Sawdust and Shavings	SW
HW Sawdust and Shavings	HW
SW Chips	SW
Pellets	

4.9) Energy Consumption, Water Consumption, and Total Emissions: Btu or Gallons or Gr

	Forest management
Energy Consumption: Btu/mmBtu	
Total energy	1,386
Fossil energy	1,379
Coal	10
Natural gas	143
Petroleum	1,226
Water consumption: gallons/mmBtu	0.03
VOC	0.05
CO	0.25
NOx	0.53
PM10	0.04
PM2.5	0.04
SOx	0.01
BC	0.03
OC	0.01
CH4	0.13
N2O	0.00
CO2	106
CO2 (w/ C in VOC & CO)	107
GHG	111
Urban Emissions: grams/mmBtu	
VOC	0.003
CO	0.002
NOx	0.003
PM10	0.001
PM2.5	0.001
SOx	0.001
BC	0.000
OC	0.000

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	CO2 Capture
Energy efficiency	
Urban emission share	
Loss factor	
Shares of hydrogen as process fuels	
Natural gas	
Hydrogen	
Electricity	
Natural gas	
Feed loss	
Energy and material use: Btu or grams per kg of CO2, or except as noted	
Hydrogen	
Electricity	1,356.35
Natural gas	
Fuel gas	
Feedstock loss	
Brominated Activated Carbon (grams)	0.037
Ammonia, 19 wt% (grams)	1.603
SCR catalyst (ft^3)	0.000
Triethylene glycol (grams)	0.061
Fly Ash, waste (grams)	0.000
Bottom Ash, waste (grams)	0.000
SCR Catalyst, waste (ft^3)	0.000
Triethylene Glycol, waste (liter)	0.000
Thermal Reclaimer Unit Waste (grams)	0.087
Prescrubber Blowdown Waste (grams)	0.559
Total energy	6,711
Fossil fuels	121
Coal	2
Natural gas	66
Petroleum	53
Water consumption, gallons/kg CO2	0.17
Total emissions: grams/kg CO2	
VOC	0.023
CO	0.513
NOx	0.302
PM10	0.032
PM2.5	0.030
SOx	0.052
BC	0.005
OC	0.010
CH4	0.064
N2O	0.025
CO2	7.281
Urban emissions: grams/kg CO2	
VOC	0.074
CO	0.007

NOx	0.004
PM10	0.000
PM2.5	0.000
SOx	0.001
BC	0.000
OC	0.000

4.10) Biomass Combustion Stage Energy Use, Water Consumption, and Emissions of Elec

	Total
	Feedstock
Total energy	46,638
Fossil fuels	45,744
Coal	1,272
Natural gas	5,909
Petroleum	38,563
Water consumption	1.35
VOC	1.22
CO	7.74
NOx	11.68
PM10	0.80
PM2.5	0.68
SOx	0.31
BC	0.48
OC	0.14
CH4	4.48
N2O	0.06
CO2	3,523
CO2 (w/ C in VOC & CO)	3,539
GHG	3,688

4.11) Energy Consumption, Water Consumption, and Total Emissions of biomass feedsto

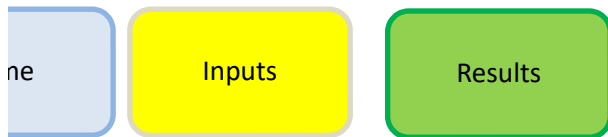
	Forest management
Energy Consumption: Btu/ton	
Total energy	-
Fossil energy	-
Coal	-
Natural gas	-
Petroleum	-
Water consumption: gallons/ton	-
VOC	-
CO	-
NOx	-
PM10	-
PM2.5	-
SOx	-

BC	-
OC	-
CH4	-
N2O	-
CO2	-
CO2 (w/ C in VOC & CO)	-
GHG	-
Urban Emissions: grams/Ton	
VOC	-
CO	-
NOx	-
PM10	-
PM2.5	-
SOx	-
BC	-
OC	-

	WA
Energy efficiency	
Urban emission share	
Energy use: Btu (except as noted)	
Natural gas: process fuel	
Total energy	4,901,384
Fossil fuels	45,744
Coal	1,272
Natural gas	5,909
Petroleum	38,563
Water consumption, gallons	125.25
Total emissions: grams	
VOC	11.041
CO	371.944
NOx	220.832
PM10	23.428
PM2.5	21.903
SOx	37.926
BC	3.409
OC	7.062
CH4	39.286
N2O	18.584
CO2	2,825
Urban emissions: grams	
VOC	0.237
CO	4.974
NOx	2.957
PM10	0.322
PM2.5	0.296
SOx	0.563
BC	0.040

OC

0.094



- 1: General (mixed), 2: specific (Dougals-fir, Spruce/fir, Pine)
- 1: Waste chips from lumber mills, 2: Logging residues, 3: Pulp logs
- 1: Mill residues (shavings and sawdust), 2: Logging residues, 3: Pulp logs
- 1: Calculated based on representative species , 2: User defined values (LURA results by default)
- 1: U.S. weighted average, 2: NERC level data, 3: User defined data
- 1: None , 2:GWP (100 years) is 900

Sawdust/shavings	
3	1: Residue - does not share energy use at lumber mills, 2: process-level
3	

/ Shares, and Power Plant Energy Conversion Efficiencies

cies

ASCC	FRCC	HICC	MRO
21.7%	18.7%	20.6%	20.6%
100.0%	100.0%	100.0%	100.0%
0.032	0.013	0.162	0.032
1.182	1.080	0.561	1.182
0.679	0.848	1.770	0.679
0.073	0.098	0.013	0.073
0.069	0.094	0.013	0.069
0.000	0.045	0.298	0.000
0.010	0.013	0.002	0.010
0.022	0.031	0.004	0.022
0.113	0.113	0.113	0.113
0.060	0.060	0.060	0.060

Biomass power plant

Grid loss (%) (Default are eGRID 2018)			
Alaska	Hawaii	Eastern	Western
5.12%	5.14%	4.88%	4.80%

CA	ID	AZ	MN
WECC	WECC	WECC	MRO
Western	Western	Western	Western

ant (130 MWe capacity)

1--base plant electricity utilization

1--US mix, 2--NGCC electricity, 3--Coal IGCC electricity, 4--Biomass IGCC electricity, 5--Ren

Douglas-Fir	Spruce/fir	Alder/Maple	Maple/beech/birch
52.0%	50.2%	50.2%	49.6%
0.0%	0.0%	0.0%	0.1%
16,742,000	15,704,000	15,748,000	15,670,000
17,090,000	16,842,000	16,908,000	16,824,000
0.50	0.41	0.48	0.58
45%	45%	45%	45%

CA	ID	AZ	MN
30%	30%	30%	30%
30%	30%	30%	30%
31.5%	19.5%	31.5%	28.4%
31.5%	19.5%	31.5%	28.4%
46.2%	33.0%	46.2%	32.3%
8%	8%	8%	8%

CA	ID	AZ	MN
Douglas-Fir	Douglas-Fir	Pine	Spruce/fir
Oak/hickory	Spruce/fir	Aspen	Aspen
SW	Aspen	SW	SW

CA	ID	AZ	MN
100%	50%	100%	100%
-	50%	-	-
100%	100%	100%	100%
-	-	-	-

CA	ID	AZ	MN
52.0%	51.1%	52.0%	50.2%
0.0%	0.0%	0.1%	0.0%
16,742,000	16,223,000	16,646,000	15,704,000
17,090,000	16,966,000	17,774,000	16,842,000
0.40	0.40	0.42	0.37
45%	39%	39%	45%
0.40	0.40	0.42	0.37
45%	39%	39%	45%

CA	ID	AZ	MN
50.8%	50.4%	50.4%	50.4%
0.1%	0.1%	0.1%	0.1%
16,114,000	15,704,000	15,704,000	15,704,000
17,258,000	16,122,000	16,122,000	16,122,000
N/A	0.43	0.51	0.44
0%	50%	47%	49%
0.65	0.43	0.51	0.44
45%	50%	47%	49%

CA	ID	AZ	MN
0.284	0.467	0.577	0.355
-	0.000	0.104	0.313
-	0.045	0.077	0.013
-	0.000	0.069	0.087
0.716	0.485	0.150	0.063
-	0.000	-	0.165
-	-	0.022	-
-	0.002	0.000	0.003

CA	ID	AZ	MN
16,742,000	16,223,000	16,646,000	15,704,000
16,114,000	15,704,000	15,704,000	15,704,000
16,742,000	16,223,000	16,646,000	15,704,000
16,114,000	15,704,000	15,704,000	15,704,000
16,742,000	16,223,000	16,646,000	15,704,000
16,114,000	15,704,000	15,704,000	15,704,000
16,742,000	16,223,000	16,646,000	15,704,000
16,742,000	16,223,000	16,646,000	15,704,000

CA	ID	AZ	MN
0.284	0.467	0.583	0.355
-	0.000	0.100	0.313
-	0.045	0.078	0.013
-	0.000	0.065	0.087
0.716	0.485	0.151	0.063
-	0.000	-	0.165
-	-	0.022	-
-	0.002	0.000	0.003

Roundwood

NE/NC SW	NE/NC HW	SE (Pine)	Eucalyptus
65	98	25	6
-	-	4,555,169	5,831,009
-	-	-	-
-	-	-	-
-	-	-	-
-	-	103,100	337,097
-	-	12,800	136,000
-	-	-	165,000
-	-	-	2,000,000
-	-	1,360	21,340
-	-	-	-

Residues			
Pine_Res	Douglas-Fir_Res	Spruce/Fir_Res	PNW_Costal
172.00	31.71	13.54	
	0.00	0.00	
98,070	117,168	83,228	216,981
	1,645	-	
1,961	2,560	-	3,906

CA	ID	AZ	MN
Douglas-Fir_Res	Douglas-Fir_Res	Pine_Res	Spruce/Fir_Res
PNW_Costal	INW	SE (Pine)	NC SW

Mill Residue Processing	Wood chipping	Pellets from Luml (South-E
Mill process share		
Loading to truck		
	Chipping off-site	Drying wet residues

	24,008	66,546	
	431	1,194	
			125,056
			239
			506,449

Sawing stage (log to rough)				
Mass Balance				
INW	SE	NE/NC (SW)	NE/NC (HW)	
52.0%	52.1%	33.9%	59.4%	
32.0%	30.7%	37.1%	15.5%	
4.0%	9.7%	11.2%	13.6%	
1.0%	2.4%	4.7%	0.2%	
9.0%	5.0%	13.2%	11.2%	

Planning stage (rough sawn lumber)				
Mass Balance				
INW	SE	NE/NC_SW	NE/NC_HW	
82.0%	90.1%	90.4%	81.4%	
0.0%	0.2%	0.5%	0.0%	
18.0%	9.6%	9.0%	18.6%	

Payload (short ton)
25

Logging residues	Mill residues
18	18

Energy Consumption: Btu/mile
17,095
13,567

CA	ID	AZ	MN
39.3	50.3	60.4	33.4
-	72.2	94.1	31.0
-	51.1	64.4	34.9
-	74.7	67.2	34.7
72.7	74.6	192.0	28.9
-	157.2	-	53.0
-	-	139.0	-
-	153.2	168.2	22.0

Transportation
0.0%

Harvest or residue collection	Forest Residue Processing	Mill Residue Processing	
Harvest or residue collection	Grinding & Loading	Mill process share	Loading to truck
100.0%	100.0%	100.0%	

0%	0%	0%	0%
----	----	----	----

Each Stage

INW	NC SW	NC HW	NE (SW)
30,547	-	-	-
30,392	-	-	-
216	-	-	-
3,147	-	-	-
27,029	-	-	-
1	-	-	-
1.20	-	-	-
5.45	-	-	-
11.65	-	-	-
0.82	-	-	-
0.80	-	-	-
0.14	-	-	-
0.60	-	-	-
0.17	-	-	-
2.88	-	-	-

0.06	-	-	-
2,341	-	-	-
0.072	-	-	-
0.049	-	-	-
0.075	-	-	-
0.013	-	-	-
0.011	-	-	-
0.027	-	-	-
0.001	-	-	-
0.002	-	-	-

INW	NC SW	NC HW	NE (SW)
308,468	382,609	303,680	273,507
306,920	380,689	302,157	272,135
2,147	2,664	2,114	1,904
31,551	39,135	31,062	27,976
273,221	338,891	268,981	242,255
6	8	6	5

12.15	15.07	11.96	10.78
55.03	68.26	54.17	48.79
117.73	146.02	115.90	104.38
8.33	10.33	8.20	7.39
8.04	9.97	7.91	7.13
1.36	1.69	1.34	1.21
6.02	7.47	5.93	5.34
1.71	2.12	1.68	1.52
29.08	36.07	28.63	25.78
0.59	0.73	0.58	0.52
23,647.62	29,331.40	23,280.59	20,967.49

0.724	0.898	0.712	0.642
0.494	0.613	0.487	0.438
0.753	0.934	0.741	0.667
0.130	0.161	0.128	0.115
0.112	0.138	0.110	0.099
0.269	0.334	0.265	0.238
0.014	0.018	0.014	0.013
0.020	0.025	0.020	0.018

Mill Residue Collection	Wood chipping	Pellets from Luml
		S
0%	0%	

	Mill process share	Loading	Chipping & Loading	Drying wet residues
	-	28,853	79,976	760,256
	-	28,708	79,575	198,924
	-	201	557	78,657
	-	2,951	8,180	117,781
	-	25,556	70,838	2,486
	-	1	2	21
	-	1.14	3.15	2.13
	-	5.15	14.27	11.26
	-	11.01	30.52	42.89
	-	0.78	2.16	2.36
	-	0.75	2.08	1.56
	-	0.13	0.35	30.88
	-	0.56	1.56	0.14
	-	0.16	0.44	0.46
	-	2.72	7.54	36.71
	-	0.06	0.15	3.39
	-	2,212	6,131	64,074
	0	0	0	-49,012
	-	0.068	0.188	0.123
	-	0.046	0.128	1.398
	-	0.070	0.195	2.911
	-	0.012	0.034	0.331
	-	0.010	0.029	0.277
	-	0.025	0.070	2.899
	-	0.001	0.004	0.013
	-	0.002	0.005	0.076

WA			
HW Pulp Logs	SW LogRes	HW LogRes	SW Mill residues
Truck	Truck	Truck	Truck
5.0%	5.0%	5.0%	5.0%
0.0%	0.0%	0.0%	0.0%
-	-	-	23.6
100%	100%	100%	100%

1243 987	1357 1077	1357 1077	1386 1100
-	-	-	69,413
-	-	-	69,065
-	-	-	483
-	-	-	7,100
-	-	-	61,481
-	-	-	1

-	-	-	0.839
-	-	-	11.839
-	-	-	8.062
-	-	-	0.450
-	-	-	0.128
-	-	-	0.312
-	-	-	0.012
-	-	-	0.021
-	-	-	6.494
-	-	-	0.021
0	0	0	5328

-	-	-	0.183
-	-	-	0.667
-	-	-	0.518
-	-	-	0.048
-	-	-	0.028
-	-	-	0.062
-	-	-	0.003
-	-	-	0.005

CA	ID	AZ	MN
U.S.	U.S.	U.S.	U.S.

0.032	0.032	0.032	0.032
1.182	1.182	1.182	1.182
0.679	0.679	0.679	0.679
0.073	0.073	0.073	0.073
0.069	0.069	0.069	0.069
0.122	0.122	0.122	0.122
0.010	0.010	0.010	0.010
0.022	0.022	0.022	0.022
0.113	0.113	0.113	0.113
0.060	0.060	0.060	0.060
1,627	1,650	1,643	1,677
-1,629	-1,652	-1,646	-1,680

lets)

CA		ID	
Urban	Total	Urban	Total
0.000	0.034	0.000	0.034
0.016	1.243	0.016	1.243
0.009	0.714	0.009	0.714
0.001	0.077	0.001	0.077
0.001	0.072	0.001	0.072
0.002	0.128	0.002	0.128
0.000	0.010	0.000	0.010
0.000	0.024	0.000	0.024
	0.119		0.119
	0.063		0.063
	-2		-2

tes (wall outlets)

CA		ID	
Urban	Total	Urban	Total
	4,854,745		4,854,745
0.128	9.824	0.128	9.824
4.735	364.205	4.735	364.205
2.719	209.152	2.719	209.152
0.294	22.624	0.294	22.624
0.276	21.220	0.276	21.220
0.489	37.613	0.489	37.613
0.038	2.928	0.038	2.928
0.090	6.918	0.090	6.918
	34.807		34.807
	18.528		18.528
	-699		-699

CA	ID	AZ	MN
164.6	279.7	340.1	219.5
-	0.2	61.6	193.6
-	27.1	45.3	8.3
-	0.0	40.4	54.0
415.3	290.5	88.3	39.0
-	0.0	-	102.2
-	-	13.05	-
-	0.94	0.24	1.62

lbs CO2 per mmBtu			
WA	CA	ID	AZ
163.500	296.564	495.154	612.446
0.000	0.000	0.366	107.377

0.000	0.000	48.005	81.614
0.000	0.000	0.083	70.510
826.607	748.291	514.276	159.084
56.115	0.000	0.002	0.000
0.000	0.000	0.000	23.492
0.000	0.000	1.672	0.438

Quantities of feedstock production per mmBtu of Electricity Available at User Sites (wall outlets)

WA			
Tree Harvest or Residue Collection	Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving
11,833	10,714	3,637	19,068
11,774	10,660	2,958	18,973
82	75	973	133
1,210	1,096	1,509	1,950
10,481	9,490	476	16,889
0.23	0.21	0.50	0.38
0.47	0.42	0.04	0.23
2.11	1.91	0.22	3.25
4.52	4.09	0.33	2.21
0.32	0.29	0.03	0.12
0.31	0.28	0.02	0.04
0.05	0.05	0.12	0.09
0.23	0.21	0.01	0.00
0.07	0.06	0.01	0.01
1.12	1.01	0.44	1.78
0.02	0.02	0.00	0.01
907	821	225	1,464
912	826	225	1,470
951	861	240	1,524
0.028	0.025	0.003	0.050
0.019	0.017	0.018	0.183
0.029	0.026	0.037	0.142
0.005	0.005	0.004	0.013
0.004	0.004	0.004	0.008
0.010	0.009	0.036	0.017
0.001	0.000	0.000	0.001
0.001	0.001	0.001	0.001

WA	CA	II
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CO2 Transportation	CO2 Capture	CO2 Transportation	CO2 Capture
7.77	1,356.35	7.77	1,356.35
	0.037		0.037
	1.603		1.603
	0.000		0.000
	0.061		0.061
	0.000		0.000
	0.000		0.000
	0.000		0.000
	0.000		0.000
	0.087		0.087
	0.559		0.559
8	6,773	8	6,810
0	183	0	217
0	2	0	3
0	72	0	77
0	109	0	137
0.00	0.17	0.00	0.17
0.000	0.024	0.000	0.026
0.000	0.524	0.000	0.530
0.000	0.314	0.000	0.329
0.000	0.033	0.000	0.034
0.000	0.030	0.000	0.031
0.000	0.052	0.000	0.053
0.000	0.005	0.000	0.006
0.000	0.010	0.000	0.010
0.000	0.069	0.000	0.073
0.000	0.025	0.000	0.025
0.000	12.061	0.000	14.679
0.000	0.074	0.000	0.074
0.000	0.007	0.000	0.007

0.000	0.005	0.000	0.005
0.000	0.000	0.000	0.001
0.000	0.000	0.000	0.000
0.000	0.001	0.000	0.001
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000

Electric Generation: Btu or Gallons or Grams per mmBtu of Electricity Available at User Sites

WA			
	Urban		Total
Fuel	Feedstock	Fuel	Feedstock
4,854,745			92,456
0			91,433
0			1,445
0			10,420
0			79,568
123.90			2.19
9.82	0.109	0.128	2.12
364.21	0.240	4.735	15.71
209.15	0.238	2.719	20.37
22.62	0.028	0.294	1.36
21.22	0.020	0.276	1.07
37.61	0.074	0.489	0.50
2.93	0.002	0.038	0.73
6.92	0.004	0.090	0.22
34.81			8.76
18.53			0.09
-699			7,047
-96			7,079
6,000			7,364

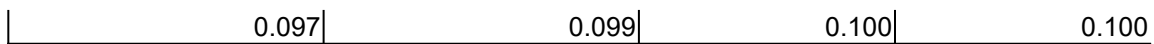
Inputs: Btu or Gallons or Grams of feedstock production per ton

Hardwood chips from pulp log (ME)			
Tree Harvest or Residue Collection	Biomass Processing	Transportation & receiving	Total
273,507	79,976	89,066	442,549
272,135	79,575	88,620	440,329
1,904	557	620	3,081
27,976	8,180	9,110	45,266
242,255	70,838	78,889	391,983
5.400	1.579	1.758	8.737
10.776	3.151	1.077	15.004
48.792	14.267	15.191	78.250
104.383	30.523	10.345	145.251
7.386	2.160	0.577	10.123
7.127	2.084	0.164	9.375
1.208	0.353	0.400	1.962

5.340	1.561	0.015	6.916
1.517	0.444	0.027	1.988
25.782	7.539	8.332	41.654
0.522	0.153	0.027	0.702
20,967	6,131	6,837	33,935
21,078	6,163	6,864	34,105
21,989	6,430	7,120	35,538
0.642	0.188	0.235	1.064
0.438	0.128	0.856	1.423
0.667	0.195	0.665	1.528
0.115	0.034	0.061	0.210
0.099	0.029	0.036	0.164
0.238	0.070	0.080	0.388
0.013	0.004	0.004	0.020
0.018	0.005	0.006	0.029

CA	ID	AZ	MN
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4,947,201	4,974,250	5,002,130	4,997,021
91,433	116,533	146,205	138,484
1,445	2,177	1,570	1,884
10,420	13,724	19,292	15,391
79,568	100,632	125,344	121,210
126.09	126.62	127.35	120.96
11.939	13.087	14.082	14.410
379.919	384.697	390.085	388.761
229.518	240.560	245.370	253.537
23.982	24.777	25.145	25.714
22.290	23.083	23.329	24.059
38.115	38.350	38.799	38.437
3.660	4.255	4.356	5.009
7.142	7.312	7.355	7.521
43.567	46.057	49.047	48.082
18.617	18.685	18.853	18.758
6,348.656	8,279.092	10,459	9,971
0.355	0.411	0.485	0.460
5.316	5.310	5.533	5.215
3.234	3.279	3.458	3.241
0.350	0.360	0.376	0.364
0.314	0.324	0.333	0.330
0.599	0.640	0.646	0.643
0.042	0.044	0.045	0.045



)

rel mass-based allocation, 3: process-level economic allocation

Woody Biomss				
Boiler				
NPCC	RFC	SERC	SPP	TRE
22.4%	21.5%	24.4%	21.7%	26.0%
100.0%	100.0%	100.0%	100.0%	100.0%
0.048	0.007	0.005	0.032	0.002
1.763	0.962	0.598	1.182	0.208
0.553	1.164	0.695	0.679	0.521
0.072	0.032	0.047	0.073	0.009
0.067	0.028	0.046	0.069	0.008
0.016	0.376	0.048	0.000	0.006
0.009	0.004	0.006	0.010	0.001
0.022	0.009	0.015	0.022	0.003
0.108	0.182	0.113	0.113	0.113
0.056	0.112	0.060	0.060	0.060

ERCOT	User defined
4.87%	4.9%

IN	NY	ME	TN	NC
RFC	NPCC	NPCC	SERC	SERC
Eastern	Eastern	Eastern	Eastern	Eastern

ewable (Wind), 6-Nuclear

Aspen	Oak/hickory	Eucalyptus	Poplar	Willow
50.4%	50.8%	50.6%	50.1%	48.7%
0.1%	0.1%	0.0%	0.0%	0.1%
15,704,000	16,114,000	16,276,000	15,929,000	15,396,000
16,122,000	17,258,000	16,908,000	17,062,000	16,524,000
0.39	0.65			
45%	45%	45%	45%	45%

IN	NY	ME	TN	NC
30%	30%	30%	30%	30%
30%	30%	30%	30%	30%
28.4%	28.4%	28.4%	38.3%	38.3%
28.4%	28.4%	28.4%	38.3%	38.3%
32.3%	32.3%	32.3%	49.9%	49.9%
8%	8%	8%	8%	8%

IN	NY	ME	TN	NC
Pine	Pine	Spruce/fir	Pine	Pine
Oak/hickory	Maple/beech/birch	Maple/beech/birch	Oak/hickory	Oak/hickory
HW	HW	SW	HW	SW

IN	NY	ME	TN	NC
100%	100%	100%	100%	100%
-	-	-	-	-
100%	100%	100%	100%	100%
-	-	-	-	-

IN	NY	ME	TN	NC
52.0%	52.0%	50.2%	52.0%	52.0%
0.1%	0.1%	0.0%	0.1%	0.1%
16,646,000	16,646,000	15,704,000	16,646,000	16,646,000
17,774,000	17,774,000	16,842,000	17,774,000	17,774,000
0.44	0.37	0.37	0.44	0.45
37%	46%	44%	44%	45%
0.44	0.37	0.37	0.44	0.45
37%	46%	44%	44%	45%

IN	NY	ME	TN	NC
50.8%	49.6%	49.6%	50.8%	50.8%
0.1%	0.1%	0.1%	0.1%	0.1%
16,114,000	15,670,000	15,670,000	16,114,000	16,114,000
17,258,000	16,824,000	16,824,000	17,258,000	17,258,000
0.55	0.52	0.53	0.55	0.00
43%	40%	41%	43%	0%
0.55	0.52	0.53	0.55	0.65
43%	40%	41%	43%	45%

IN	NY	ME	TN	NC
0.004	0.118	0.329	0.053	0.978
0.234	0.223	0.182	0.091	-
0.000	-	0.066	0.001	-
0.018	-	0.065	0.011	-
0.004	0.005	0.304	0.088	-
0.737	0.653	0.052	0.753	-
-	-	-	-	-
0.003	-	0.000	0.003	0.022

IN	NY	ME	TN	NC
16,646,000	16,646,000	15,704,000	16,646,000	16,646,000
16,114,000	15,670,000	15,670,000	16,114,000	16,114,000
16,646,000	16,646,000	15,704,000	16,646,000	16,646,000
16,114,000	15,670,000	15,670,000	16,114,000	16,114,000
16,646,000	16,646,000	15,704,000	16,646,000	16,646,000
16,114,000	15,670,000	15,670,000	16,114,000	16,114,000
16,646,000	16,646,000	15,704,000	16,646,000	16,646,000
16,114,000	15,670,000	15,704,000	16,114,000	16,646,000

IN	NY	ME	TN	NC
0.004	0.125	0.329	0.054	0.978
0.234	0.221	0.182	0.090	-
0.000	-	0.066	0.001	-
0.018	-	0.065	0.011	-
0.004	0.006	0.305	0.091	-
0.737	0.648	0.052	0.750	-
-	-	-	-	-
0.003	-	0.000	0.003	0.022

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Poplar	Willow
21	24
11,349,163	11,563,144
-	-
219,537	49,399
-	-
-	-
-	224,000
-	-
-	-
-	4,483,398
110,011	8,743
30	-

Round				
INW	NC SW	NC HW	NE (SW)	NE (HW)
57.76	124.34	123.24	124.34	123.24
57.76	0.00	22.35	0.00	22.35
256,811	318,377	252,661	227,120	227,120
4,464	5,695	4,558	4,542	4,542
IN	NY	ME	TN	NC
Pine_Res	Pine_Res	Spruce/Fir_Res	Pine_Res	Pine_Res
NC HW	NE (HW)	NE (SW)	Tennesse (HW)	SE (Pine)

ber Mill Residues East US)	Pellets from Lumber Mill Residues (Pacific Northwest)	Lumber Mill (PNW, SW)	
Pelletizing	Drying wet residues	Sawing (rough green lumber)	Planing (planned, dry lumber)

75,796			7,805	14,930
			326	221
10,118			3,237	744
500,224	102,364	497,490	67,560	33,439
		665	494	148
	3,036,616			
			13	2

h green lumber)

Economic Value Share					
PNW	INW	SE	NE/NC (SW)	NE/NC (HW)	
91.8%	92.0%	91.6%	85.0%	95.1%	
5.7%	7.2%	6.9%	11.9%	3.2%	
0.7%	0.5%	1.1%	1.8%	1.4%	
1.7%	0.1%	0.3%	0.8%	0.0%	
0.2%	0.2%	0.1%	0.5%	0.3%	

per to planned lumber)

Economic Value Share					
PNW	INW	SE	NE/NC_SW	NE/NC_HW	
99.1%	98.6%	99.3%	99.3%	98.5%	
0.2%	0.0%	0.0%	0.1%	0.0%	
0.7%	1.4%	0.7%	0.6%	1.5%	

IN	NY	ME	TN	NC	
50.3	41.6	41.4	56.4	27.8	
41.0	43.4	36.3	47.4	-	
54.6	-	51.9	20.4	-	
24.3	-	52.5	26.7	-	
73.5	52.3	60.0	69.3	-	
43.3	31.2	55.6	59.2	-	
-	-	-	-	-	
37.4	-	22.6	80.0	50.8	

Wood chipping	Pellets from Lumber Mill Residues_x000D_(South-East US)	Pellets from Lumber Mill Residues_x000D_(Pacific Northwest)
Chipping off-site	Drying wet residues	Drying wet residues
Pellet production	Pellet production	Pellet production
100.0%	100.0%	100.0%
	50.0%	20.0%
	50.0%	80.0%
	100.0%	100.0%
0%	0%	0%

Roundwood				
NE (HW)	Tennessee (SW)	Tennessee (HW)	SE (Pine)	Eucalyptus
-	-	-	45,639	534,632
-	-	-	44,968	513,906
-	-	-	957	29,782
-	-	-	23,211	342,479
-	-	-	20,800	141,645
-	-	-	3	48
-	-	-	3.60	47.42
-	-	-	7.09	80.00
-	-	-	11.06	90.97
-	-	-	1.15	12.49
-	-	-	1.03	10.62
-	-	-	2.60	49.74
-	-	-	0.44	2.48
-	-	-	0.19	1.94
-	-	-	6.09	78.27

-	-	-	0.86	10.17
-	-	-	2,908	32,036
-	-	-	0.072	0.800
-	-	-	0.106	1.586
-	-	-	0.218	3.581
-	-	-	0.020	0.303
-	-	-	0.017	0.264
-	-	-	0.101	2.067
-	-	-	0.002	0.027
-	-	-	0.005	0.079

Roundwood				
NE (HW)	Tennessee (SW)	Tennessee (HW)	SE (Pine)	Eucalyptus
273,507	434,875	466,935	192,202	106,322
272,135	432,674	464,570	191,238	105,789
1,904	3,056	3,283	1,338	740
27,976	44,993	48,343	19,659	10,875
242,255	384,625	412,944	170,241	94,174
5	9	9	4	2
10.78	21.99	23.93	7.57	4.19
48.79	297.61	333.78	34.29	18.97
104.38	155.15	165.89	73.35	40.58
7.39	10.83	11.57	5.19	2.87
7.13	10.45	11.16	5.01	2.77
1.21	1.96	2.10	0.85	0.47
5.34	7.61	8.11	3.75	2.08
1.52	2.42	2.60	1.07	0.59
25.78	41.07	44.11	18.12	10.02
0.52	0.79	0.85	0.37	0.20
20,967.49	32,945.20	35,348.57	14,734.53	8,150.83
0.642	1.531	1.677	0.451	0.249
0.438	0.732	0.789	0.308	0.170
0.667	1.115	1.201	0.469	0.259
0.115	0.198	0.214	0.081	0.045
0.099	0.171	0.184	0.069	0.038
0.238	0.401	0.432	0.168	0.093
0.013	0.021	0.023	0.009	0.005
0.018	0.030	0.032	0.012	0.007

ber Mill Residues	Pellets from Lumber Mill Residues	
E	PNW	PNW
0%	0%	

Pellet production	Drying wet residues	Pellet production	Sawing	Planning
1,115,573	3,244,147	1,009,355	150,968	86,739
895,561	162,612	791,032	121,240	71,967
315,332	64,384	312,909	42,589	21,164
480,572	96,220	468,272	65,362	33,499
99,656	2,008	9,851	13,289	17,305
87	17	85	25	8
11.29	3.29	7.26	1.56	1.26
44.03	33.88	25.81	7.75	6.34
84.65	197.57	45.75	11.29	10.19
9.39	5.56	6.61	1.26	0.95
6.40	4.48	3.74	0.85	0.74
38.90	135.34	38.25	5.26	2.66
2.18	0.55	0.20	0.28	0.38
1.61	1.42	1.04	0.22	0.17
136.27	55.89	126.11	18.45	10.26
1.40	18.79	1.20	0.19	0.12
68,040	306,069	59,986	9,204	5,477
0	-293,870	0		
0.731	0.101	0.491	0.103	0.080
5.753	1.144	5.560	0.777	0.404
11.890	2.383	11.580	1.606	0.825
1.367	0.271	1.317	0.185	0.097
1.145	0.227	1.102	0.155	0.081
11.686	2.373	11.534	1.579	0.792
0.056	0.010	0.051	0.008	0.004
0.312	0.062	0.303	0.042	0.022

HW Mill residues	SW Mill chips	Pellets	SW Pulp Logs	HW Pulp Logs
Truck	Truck	Truck	Truck	Truck
5.0%	5.0%	5.0%	5.0%	5.0%
0.0%	0.0%	0.0%	0.0%	0.0%
12.5	-	-	39.3	-
100%	100%	100%	100%	100%

1386	1765	1032	1243	1243
1100	1401	819	987	987
36,758	-	-	103,436	-
36,574	-	-	102,918	-
256	-	-	720	-
3,760	-	-	10,580	-
32,558	-	-	91,618	-
1	-	-	2	-

0.444	-	-	1.250	-
6.269	-	-	17.641	-
4.269	-	-	12.014	-
0.238	-	-	0.671	-
0.068	-	-	0.191	-
0.165	-	-	0.465	-
0.006	-	-	0.018	-
0.011	-	-	0.032	-
3.439	-	-	9.677	-
0.011	-	-	0.031	-
2822	0	0	7940	0

0.097	-	-	0.272	-
0.353	-	-	0.994	-
0.274	-	-	0.772	-
0.025	-	-	0.071	-
0.015	-	-	0.042	-
0.033	-	-	0.093	-
0.002	-	-	0.005	-
0.002	-	-	0.007	-

IN	NY	ME	TN	NC
U.S.	U.S.	U.S.	U.S.	U.S.

0.032	0.032	0.032	0.032	0.032
1.182	1.182	1.182	1.182	1.182
0.679	0.679	0.679	0.679	0.679
0.073	0.073	0.073	0.073	0.073
0.069	0.069	0.069	0.069	0.069
0.122	0.122	0.122	0.122	0.122
0.010	0.010	0.010	0.010	0.010
0.022	0.022	0.022	0.022	0.022
0.113	0.113	0.113	0.113	0.113
0.060	0.060	0.060	0.060	0.060
1,650	1,655	1,670	1,648	1,636
-1,652	-1,658	-1,672	-1,651	-1,638

AZ			MN		
Urban	Total	Urban	Total	Urban	
0.000	0.034	0.000	0.034	0.000	
0.016	1.243	0.016	1.243	0.016	
0.009	0.714	0.009	0.714	0.009	
0.001	0.077	0.001	0.077	0.001	
0.001	0.072	0.001	0.072	0.001	
0.002	0.128	0.002	0.128	0.002	
0.000	0.010	0.000	0.010	0.000	
0.000	0.024	0.000	0.024	0.000	
	0.119		0.119		
	0.063		0.063		
	-2		-2		

Bio

AZ			MN		
Urban	Total	Urban	Total	Urban	
	4,854,745		4,854,745		
0.128	9.824	0.128	9.824	0.128	
4.735	364.205	4.735	364.205	4.735	
2.719	209.152	2.719	209.152	2.719	
0.294	22.624	0.294	22.624	0.294	
0.276	21.220	0.276	21.220	0.276	
0.489	37.613	0.489	37.613	0.489	
0.038	2.928	0.038	2.928	0.038	
0.090	6.918	0.090	6.918	0.090	
	34.807		34.807		
	18.528		18.528		
	-699		-699		

IN	NY	ME	TN	NC	
2.5	72.8	203.4	31.7	570.7	
140.9	137.2	112.9	54.5	-	
0.0	-	41.1	0.5	-	
11.1	-	40.5	6.8	-	
2.3	3.3	188.4	52.9	-	
444.0	401.5	32.3	451.8	-	
-	-	-	-	-	
1.61	-	0.13	1.60	12.57	

MN	IN	NY	ME	TN	
381.710	4.466	131.163	353.690	57.102	
337.835	247.794	235.778	193.988	95.767	

14.374	0.025	0.000	71.493	0.846
94.205	19.504	0.000	69.627	11.893
67.875	4.163	6.006	327.593	95.316
178.345	780.866	689.839	55.429	794.606
0.000	0.000	0.000	0.000	0.000
2.812	2.834	0.000	0.233	2.820

CA				
Forest management	Tree Harvest or Residue Collection	Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving
2,514	21,464	12,574	3,076	52,828
2,501	21,356	12,511	2,502	52,563
18	149	88	823	368
259	2,195	1,286	1,276	5,403
2,225	19,011	11,137	403	46,792
0.06	0.42	0.25	0.42	1.04
0.10	0.85	0.50	0.04	0.64
0.45	3.83	2.24	0.18	9.01
0.96	8.19	4.80	0.28	6.14
0.07	0.58	0.34	0.03	0.34
0.07	0.56	0.33	0.02	0.10
0.01	0.09	0.06	0.10	0.24
0.05	0.42	0.25	0.01	0.01
0.01	0.12	0.07	0.01	0.02
0.24	2.02	1.19	0.37	4.94
0.00	0.04	0.02	0.00	0.02
193	1,645	964	190	4,055
194	1,654	969	191	4,071
202	1,726	1,011	203	4,223
0.006	0.050	0.030	0.002	0.139
0.004	0.034	0.020	0.015	0.508
0.006	0.052	0.031	0.031	0.394
0.001	0.009	0.005	0.004	0.036
0.001	0.008	0.005	0.003	0.022
0.002	0.019	0.011	0.031	0.047
0.000	0.001	0.001	0.000	0.003
0.000	0.001	0.001	0.001	0.004

D	AZ	MN
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CO2 Transportation	CO2 Capture	CO2 Transportation	CO2 Capture	CO2 Transportation
7.77	1,356.35	7.77	1,356.35	7.77
	0.037		0.037	
	1.603		1.603	
	0.000		0.000	
	0.061		0.061	
	0.000		0.000	
	0.000		0.000	
	0.000		0.000	
	0.000		0.000	
	0.087		0.087	
	0.559		0.559	
8	6,848	8	6,841	8
0	257	0	247	0
0	2	0	3	0
0	84	0	79	0
0	171	0	165	0
0.00	0.17	0.00	0.16	0.00
0.000	0.027	0.000	0.028	0.000
0.000	0.538	0.000	0.536	0.000
0.000	0.336	0.000	0.347	0.000
0.000	0.034	0.000	0.035	0.000
0.000	0.032	0.000	0.033	0.000
0.000	0.053	0.000	0.053	0.000
0.000	0.006	0.000	0.007	0.000
0.000	0.010	0.000	0.010	0.000
0.000	0.077	0.000	0.076	0.000
0.000	0.026	0.000	0.026	0.000
0.000	17.636	0.000	16.974	0.000
0.000	0.074	0.000	0.074	0.000
0.000	0.008	0.000	0.007	0.000

0.000	0.005	0.000	0.005	0.000
0.000	0.001	0.000	0.001	0.000
0.000	0.000	0.000	0.000	0.000
0.000	0.001	0.000	0.001	0.000
0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000

(wall outlets)

CA			II	
Urban			Total	
Fuel	Feedstock	Fuel	Feedstock	Fuel
4,854,745			119,505	4,854,745
0			116,533	0
0			2,177	0
0			13,724	0
0			100,632	0
123.90			2.72	123.90
9.82	0.227	0.128	3.26	9.82
364.21	0.582	4.735	20.49	364.21
209.15	0.515	2.719	31.41	209.15
22.62	0.055	0.294	2.15	22.62
21.22	0.038	0.276	1.86	21.22
37.61	0.110	0.489	0.74	37.61
2.93	0.004	0.038	1.33	2.93
6.92	0.007	0.090	0.39	6.92
34.81			11.25	34.81
18.53			0.16	18.53
-699			8,978	-699
-96			9,020	-96
6,000			9,398	6,000

Energy Inputs

**Electricity for CO2 capture
(per mmBtu)**

IN	NY	ME	TN	NC
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4,938,435	4,935,539	4,968,178	4,954,140	4,978,963
79,152	79,054	112,124	96,663	118,587
2,981	2,477	1,558	3,312	3,482
11,204	10,559	12,500	13,291	20,600
64,967	66,017	98,067	80,060	94,506
125.00	125.92	126.33	126.45	127.31
11.838	12.033	13.102	12.194	14.258
378.515	378.532	383.818	392.196	384.129
228.232	230.076	240.791	228.696	245.269
23.932	24.075	24.801	23.931	25.264
22.305	22.474	23.135	22.212	23.627
38.345	38.184	38.210	38.364	39.238
3.675	3.816	4.308	3.570	4.589
7.149	7.185	7.323	7.137	7.421
42.710	42.597	45.532	44.373	46.991
18.635	18.630	18.678	18.622	18.958
5,393.245	5,387.084	7,942	6,725	8,274
0.317	0.316	0.401	0.388	0.393
5.178	5.122	5.250	5.374	5.143
3.166	3.120	3.221	3.321	3.226
0.345	0.342	0.355	0.359	0.358
0.313	0.311	0.321	0.321	0.327
0.645	0.627	0.615	0.669	0.698
0.042	0.042	0.043	0.043	0.044



WECC	User defined
22.7%	21.7%
100.0%	
0.031	0.032
0.807	1.182
0.714	0.679
0.084	0.073
0.078	0.069
0.065	0.122
0.011	0.010
0.025	0.022
0.113	0.113
0.060	0.060

GA	LA
SERC	SERC
Eastern	Eastern

GA	LA
30%	30%
30%	30%
38.3%	38.3%
38.3%	38.3%
49.9%	49.9%
8%	8%

GA	LA
Pine	Pine
Oak/hickory	Oak/hickory
SW	SW

GA	LA
100%	100%
-	-
100%	100%
-	-

GA	LA
52.0%	52.0%
0.1%	0.1%
16,646,000	16,646,000
17,774,000	17,774,000
0.48	N/A
44%	N/A
0.48	0.45
44%	45%

GA	LA
50.8%	50.8%
0.1%	0.1%
16,114,000	16,114,000
17,258,000	17,258,000
0.53	N/A
44%	N/A
0.53	0.65
44%	45%

GA	LA
0.162	-
0.059	-
0.007	-
0.069	-
0.651	0.996
0.052	0.004
-	-
-	-

GA	LA
16,646,000	16,646,000
16,114,000	16,114,000
16,646,000	16,646,000
16,114,000	16,114,000
16,646,000	16,646,000
16,114,000	16,114,000
16,646,000	16,646,000
16,646,000	16,646,000

GA	LA
0.163	-
0.057	-
0.007	-
0.068	-
0.655	0.996
0.050	0.004
-	-
-	-

wood					
Tennessee (SW)		Tennessee (HW)		SE (Pine)	
124.34		123.24		252.43	
0.00		22.35			
306,278		326,299		159,605	
38,974		44,369			
21,547		23,074		3,192	

GA	LA
Pine_Res	Pine_Res
SE (Pine)	SE (Pine)

Lumber Mill (INW, SW)		Lumber Mill (SE, SW)		Lumber Mill (I
Sawing (rough green lumber)	Planing (planned, dry lumber)	Sawing (rough green lumber)	Planing (planned, dry lumber)	Sawing (rough green lumber)
per m3 lumber (rough green or planed dry)				

39,871	19,783	7,126	11,877	30,065
2,134	1,067	533	6,224	492
6,868	3,410	1,472	986	19,675
155,560	83,939	97,587	75,067	95,438
3,052	1,369		1,010	
13	2	21	8	3

Market prices for lumber mill outputs

Items	Price (\$/dry ton)
Lumber	564
Chips	72
Sawdust	37
Hogfuel	37
Bark	8

Mill residues generated from sawing and planing (kg dry bone per m³ lumber)

	PNW
Chips from sawing, kg/m ³)	211.7
Sawdust/Shavings from sawing (kg/m ³)	48.8
Chips from planing (kg/m ³)	6.6
Sawdust/Shavings from planing (kg/m ³)	52.96
Share of chips from sawing (%)	97.0%
Share of sawdust/shavings from sawing (%)	48.0%

GA	LA
40.2	-
45.8	-
20.1	-
23.6	-
50.6	41.8
64.7	59.4
-	-
-	-

Lumber Mill (PNW)		Lumber Mill (INW)		Lumber Mill (INW)
Sawing	Planning	Sawing	Planning	Sawing
100.0%	100.0%	100.0%	100.0%	100.0%
0%	0%	0%	0%	0%

Poplar	Willow
171,857	132,977
157,563	130,282
20,473	3,925
78,071	63,130
59,019	63,227
7	7
13.16	10.17
37.27	22.80
24.47	31.23
2.68	3.16
2.42	2.80
3.96	5.38
0.95	1.29
0.66	0.53
22.19	17.32

0.25	2.18
11,290	8,601
0.434	0.232
0.586	0.312
1.063	0.600
0.120	0.058
0.101	0.051
0.815	0.293
0.007	0.006
0.025	0.013

		Residues		
Poplar	Willow	Mixed_Res	Pine_Res	Douglas-Fir_Res
238,712	31,435	41,133	118,192	143,492
237,514	31,277	40,926	117,598	142,770
1,662	219	1,258	824	1,002
24,417	3,215	3,250	12,115	14,732
211,436	27,843	36,419	104,659	127,036
5	1	1	2	3
9.41	1.24	1.74	4.90	6.18
42.58	5.61	12.82	32.16	49.33
91.10	12.00	15.43	44.56	53.60
6.45	0.85	1.09	3.15	3.78
6.22	0.82	1.05	3.04	3.64
1.05	0.14	0.18	0.52	0.64
4.66	0.61	0.78	2.26	2.71
1.32	0.17	0.23	0.66	0.80
22.50	2.96	3.88	11.15	13.53
0.46	0.06	0.08	0.22	0.27
18,300.03	2,409.85	3,143.54	9,040.99	10,957.92
0.560	0.074	0.109	0.303	0.392
0.383	0.050	0.067	0.191	0.234
0.583	0.077	0.102	0.291	0.356
0.100	0.013	0.018	0.050	0.062
0.086	0.011	0.015	0.043	0.053
0.208	0.027	0.036	0.104	0.127
0.011	0.001	0.002	0.005	0.007
0.015	0.002	0.003	0.008	0.009

Lumber Mill Operation (Sawing & Planning) Unallocated (m³, green)

INW		SE		NC/NE (SW)

Sawing	Planning	Sawing	Planning	Sawing
376,652	200,425	208,652	176,163	252,815
308,014	163,409	165,775	143,077	210,639
98,258	53,001	61,455	47,382	60,441
155,119	83,175	92,842	73,956	95,784
54,638	27,233	11,478	21,739	54,414
41	17	38	21	21
4.86	2.51	1.91	2.79	3.79
30.49	15.53	10.00	43.13	18.31
36.04	18.49	12.94	13.97	31.27
3.59	1.87	1.58	1.47	2.86
2.64	1.36	1.00	1.02	2.25
12.28	6.61	7.55	5.90	7.60
1.14	0.57	0.24	0.34	1.19
0.65	0.34	0.26	0.29	0.53
45.29	24.16	25.74	21.32	29.77
0.50	0.26	0.25	0.22	0.34
23,387	12,407	12,580	10,809	16,041
0.321	0.166	0.128	0.210	0.240
1.836	0.986	1.108	0.882	1.162
3.768	2.027	2.298	1.813	2.367
0.437	0.235	0.263	0.211	0.278
0.367	0.197	0.220	0.177	0.233
3.660	1.972	2.272	1.764	2.265
0.019	0.010	0.011	0.009	0.013
0.099	0.053	0.060	0.048	0.062

CA				
SW LogRes	HW LogRes	SW Mill residues	HW Mill residues	SW Mill chips
Truck	Truck	Truck	Truck	Truck
5.0%	5.0%	5.0%	5.0%	5.0%
0.0%	0.0%	0.0%	0.0%	0.0%
-	-	72.7	-	-
100%	100%	100%	100%	100%

1357 1077	1357 1077	1386 1100	1386 1100	1765 1401
-	-	213,390	-	-
-	-	212,320	-	-
-	-	1,486	-	-
-	-	21,827	-	-
-	-	189,008	-	-
-	-	4	-	-
-	-	2.580	-	-
-	-	36.394	-	-
-	-	24.784	-	-
-	-	1.383	-	-
-	-	0.394	-	-
-	-	0.959	-	-
-	-	0.037	-	-
-	-	0.066	-	-
-	-	19.963	-	-
-	-	0.065	-	-
0	0	16380	0	0
-	-	0.562	-	-
-	-	2.051	-	-
-	-	1.593	-	-
-	-	0.147	-	-
-	-	0.087	-	-
-	-	0.191	-	-
-	-	0.010	-	-
-	-	0.014	-	-

GA	LA
U.S.	U.S.
0.032	0.032
1.182	1.182
0.679	0.679
0.073	0.073
0.069	0.069
0.122	0.122
0.010	0.010
0.022	0.022
0.113	0.113
0.060	0.060
1,638	1,636
-1,641	-1,638

IN		NY		ME	
Total	Urban	Total	Urban	Total	
0.034	0.000	0.034	0.000	0.034	
1.243	0.016	1.243	0.016	1.243	
0.714	0.009	0.714	0.009	0.714	
0.077	0.001	0.077	0.001	0.077	
0.072	0.001	0.072	0.001	0.072	
0.128	0.002	0.128	0.002	0.128	
0.010	0.000	0.010	0.000	0.010	
0.024	0.000	0.024	0.000	0.024	
0.119		0.119		0.119	
0.063		0.063		0.063	
-2		-2		-2	

mass Power Plant: Forest Residue

IN		NY		ME	
Total	Urban	Total	Urban	Total	
4,854,745		4,854,745		4,854,745	
9.824	0.128	9.824	0.128	9.824	
364.205	4.735	364.205	4.735	364.205	
209.152	2.719	209.152	2.719	209.152	
22.624	0.294	22.624	0.294	22.624	
21.220	0.276	21.220	0.276	21.220	
37.613	0.489	37.613	0.489	37.613	
2.928	0.038	2.928	0.038	2.928	
6.918	0.090	6.918	0.090	6.918	
34.807		34.807		34.807	
18.528		18.528		18.528	
-699		-699		-699	

GA	LA
94.9	-
34.5	-
4.3	-
40.7	-
381.9	581.2
30.4	2.2
-	-
-	-

NC	GA	LA
1,027.644	170.940	0.000
0.000	60.587	0.000

0.000	7.691	0.000
0.000	71.556	0.000
0.000	687.682	1,046.493
0.000	53.482	3.824
0.000	0.000	0.000
22.639	0.000	0.000

ID				
Forest management	Tree Harvest or Residue Collection	Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving
4,275	45,120	19,535	4,608	45,967
4,253	44,893	17,889	3,761	45,736
30	314	300	1,212	320
440	4,616	2,059	1,907	4,702
3,783	39,963	15,529	642	40,715
0.10	0.89	0.39	0.43	0.91
0.17	1.78	0.70	0.06	0.56
0.76	8.37	3.15	0.36	7.84
1.63	17.20	6.80	0.43	5.34
0.12	1.22	0.48	0.04	0.30
0.11	1.17	0.46	0.03	0.08
0.02	0.20	0.16	0.15	0.21
0.08	0.88	0.34	0.01	0.01
0.02	0.25	0.10	0.01	0.01
0.40	4.25	1.74	0.55	4.30
0.01	0.09	0.04	0.01	0.01
328	3,458	1,378	286	3,528
329	3,477	1,385	286	3,543
344	3,627	1,448	305	3,674
0.010	0.107	0.041	0.004	0.121
0.007	0.072	0.031	0.023	0.442
0.010	0.110	0.049	0.046	0.343
0.002	0.019	0.008	0.005	0.032
0.002	0.016	0.007	0.005	0.019
0.004	0.039	0.022	0.045	0.041
0.000	0.002	0.001	0.000	0.002
0.000	0.003	0.001	0.001	0.003
IN		NY		MI

CO2 Capture	CO2 Transportation	CO2 Capture	CO2 Transportation	CO2 Capture
1,356.35	7.77	1,356.35	7.77	1,356.35
0.037		0.037		0.037
1.603		1.603		1.603
0.000		0.000		0.000
0.061		0.061		0.061
0.000		0.000		0.000
0.000		0.000		0.000
0.000		0.000		0.000
0.000		0.000		0.000
0.087		0.087		0.087
0.559		0.559		0.559
6,761	8	6,757	8	6,802
166	0	166	0	211
4	0	4	0	2
73	0	72	0	75
89	0	90	0	134
0.17	0.00	0.17	0.00	0.17
0.024	0.000	0.025	0.000	0.026
0.522	0.000	0.522	0.000	0.529
0.312	0.000	0.315	0.000	0.329
0.033	0.000	0.033	0.000	0.034
0.030	0.000	0.031	0.000	0.031
0.053	0.000	0.053	0.000	0.053
0.005	0.000	0.005	0.000	0.006
0.010	0.000	0.010	0.000	0.010
0.068	0.000	0.068	0.000	0.072
0.025	0.000	0.025	0.000	0.025
10.765	0.000	10.757	0.000	14.222
0.074	0.000	0.074	0.000	0.074
0.007	0.000	0.007	0.000	0.007

0.004	0.000	0.004	0.000	0.005
0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000
0.001	0.000	0.001	0.000	0.001
0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000

D		AZ	
Urban		Total	Urban
Feedstock	Fuel	Feedstock	Feedstock
		147,385	4,854,745
		146,205	0
		1,570	0
		19,292	0
		125,344	0
		3.45	123.90
0.283	0.128	4.26	9.82
0.575	4.735	25.88	364.21
0.560	2.719	36.22	209.15
0.066	0.294	2.52	22.62
0.048	0.276	2.11	21.22
0.151	0.489	1.19	37.61
0.005	0.038	1.43	2.93
0.009	0.090	0.44	6.92
		14.24	34.81
		0.33	18.53
		11,158	-699
		11,211	-96
		11,725	6,000

		Electricity for transportation (per mmBtu)	Brominated Activated Carbon	Ammonia, 19 wt%
GA	LA			
			btu/grams	btu/grams
4,935,350	4,909,556	1,051,125	112.412	34.925
79,260	53,246	0	17.102	34.808
1,910	2,231	0	0.029	0.167
11,011	7,822	0	14.930	34.294
66,339	43,192	0	2.143	0.346
126.26	125.91	0.31	0.000	0.000
			grams/grams	grams/grams
11.811	10.712	0.000	0.000	0.005
378.132	373.255	0.000	0.001	0.005
226.549	217.433	0.000	0.002	0.002
23.818	23.161	0.000	0.000	0.000
22.165	21.547	0.000	0.000	0.000
38.272	38.063	0.000	0.000	0.000
3.551	3.109	0.000	0.000	0.000
7.115	6.986	0.000	0.000	0.000
42.623	40.133	0.000	0.003	0.006
18.659	18.564	0.000	0.000	0.000
5,371	3,401	0	-2.315	2.165
			grams/grams	grams/grams
0.320	0.258	0.000	0.000	0.000
5.229	5.165	0.000	0.000	0.000
3.179	3.108	0.000	0.000	0.000
0.344	0.333	0.000	0.000	0.000
0.310	0.302	0.000	0.000	0.000
0.610	0.602	0.000	0.000	0.000
0.042	0.041	0.000	0.000	0.000

	0.096	0.095	0.000	0.000	0.000
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Willow
219.00
0.00
0.00
26,626
-

VC/NE, SW)	Lumber Mill (NC/NE, HW)		Operations within power plant
Planing (planned, dry lumber)	Sawing (rough green lumber)	Planing (planned, dry lumber)	Receiving & Handling

13,845	157,449	42,077	
225	17,190	4,446	
2,625	-		
52,615	228,682	111,331 1,513	
-	2	-	

INW	SE	NE/NC_SW	NE/NC_HW
278.76	276.3	474.84	180.45
33.14	87.8	143.3	158.95
0	1.2	2.59	0
98.63	54.59	43.26	130.36
100.0%	99.6%	99.5%	100.0%
25.1%	61.7%	76.8%	54.9%

Mill (SE)	Lumber Mill (NC/NE, SW)		Lumber Mill (NC/NE, HW)		At power plant	
Planning	Sawing	Planning	Sawing	Planning	Receiving & Handling	
						50.0%
100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	50.0%
0%	0%	0%	0%	0%	0%	0%

Spruce/Fir_Res
98,261
97,768
684
10,051
87,033
2
3.87
17.53
37.50
2.65
2.56
0.43
1.92
0.54
9.26
0.19
7,532.83
0.231
0.157
0.240
0.041
0.036
0.086
0.004
0.006

			Lumber Mill Operations Allocated to Chips (per		
	NC/NE (HW)		PNW	INW	SE
			0%	0%	0%

Planning	Sawing	Planning			
126,391	670,609	282,566	36,483	88,562	47,062
103,204	569,214	233,392	29,316	72,423	37,394
33,231	145,288	70,417	10,268	23,103	13,857
51,477	236,352	111,812	15,765	36,473	20,936
18,496	187,575	51,162	3,283	12,847	2,601
9	45	20	6	10	9
1.57	13.63	4.38	0.38	1.14	0.43
7.52	145.83	40.74	1.89	7.17	2.29
12.30	95.23	30.17	2.76	8.47	2.92
1.23	8.23	2.87	0.31	0.84	0.36
0.90	6.72	2.18	0.21	0.62	0.23
4.13	18.51	8.84	1.27	2.89	1.70
0.40	3.74	1.02	0.07	0.27	0.05
0.22	1.63	0.54	0.05	0.15	0.06
15.19	77.47	33.62	4.46	10.65	5.81
0.16	0.93	0.38	0.05	0.12	0.06
7,848	43,245	17,711	2,226	5,499	2,838
0.101	0.936	0.299	0.025	0.075	0.029
0.620	2.903	1.338	0.188	0.432	0.250
1.273	5.852	2.734	0.387	0.886	0.518
0.148	0.699	0.320	0.045	0.103	0.059
0.124	0.587	0.268	0.037	0.086	0.050
1.237	5.492	2.633	0.381	0.861	0.512
0.006	0.034	0.014	0.002	0.004	0.002
0.033	0.153	0.072	0.010	0.023	0.014

	ID				
Pellets	SW Pulp Logs	HW Pulp Logs	SW LogRes	HW LogRes	SW Mill residues
Truck	Truck	Truck	Truck	Truck	Truck
5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
-	50.3	72.2	51.1	74.7	74.6
100%	100%	100%	100%	100%	100%

1032 819	1121 890	1368 1085	1357 1077	1357 1077	1180 936
-	119,518	209,095	146,674	214,476	186,431
-	118,918	208,046	145,938	213,400	185,496
-	832	1,456	1,021	1,493	1,298
-	12,225	21,387	15,002	21,938	19,069
-	105,861	185,203	129,914	189,970	165,129
-	2	4	3	4	4
-	1.445	2.528	1.773	2.593	2.254
-	20.384	35.662	25.016	36.580	31.796
-	13.881	24.285	17.035	24.910	21.653
-	0.775	1.356	0.951	1.391	1.209
-	0.221	0.386	0.271	0.396	0.344
-	0.537	0.940	0.659	0.964	0.838
-	0.021	0.036	0.025	0.037	0.032
-	0.037	0.064	0.045	0.066	0.057
-	11.181	19.561	13.722	20.065	17.441
-	0.036	0.064	0.045	0.065	0.057
0	9174	16050	11259	16463	14311
-	0.315	0.551	0.386	0.565	0.491
-	1.149	2.010	1.410	2.061	1.792
-	0.892	1.561	1.095	1.601	1.392
-	0.082	0.144	0.101	0.148	0.129
-	0.049	0.085	0.060	0.087	0.076
-	0.107	0.187	0.131	0.192	0.167
-	0.006	0.010	0.007	0.010	0.009
-	0.008	0.014	0.010	0.014	0.013

TN		NC		GA	
Urban	Total	Urban	Total	Urban	Total
0.000	0.034	0.000	0.034	0.000	0.034
0.016	1.243	0.016	1.243	0.016	1.243
0.009	0.714	0.009	0.714	0.009	0.714
0.001	0.077	0.001	0.077	0.001	0.077
0.001	0.072	0.001	0.072	0.001	0.072
0.002	0.128	0.002	0.128	0.002	0.128
0.000	0.010	0.000	0.010	0.000	0.010
0.000	0.024	0.000	0.024	0.000	0.024
	0.119		0.119		0.119
	0.063		0.063		0.063
	-2		-2		-2

TN		NC		GA	
Urban	Total	Urban	Total	Urban	Total
	4,854,745		4,854,745		4,854,745
0.128	9.824	0.128	9.824	0.128	9.824
4.735	364.205	4.735	364.205	4.735	364.205
2.719	209.152	2.719	209.152	2.719	209.152
0.294	22.624	0.294	22.624	0.294	22.624
0.276	21.220	0.276	21.220	0.276	21.220
0.489	37.613	0.489	37.613	0.489	37.613
0.038	2.928	0.038	2.928	0.038	2.928
0.090	6.918	0.090	6.918	0.090	6.918
	34.807		34.807		34.807
	18.528		18.528		18.528
	-699		-699		-699

AZ					
Forest management	Tree Harvest or Residue Colection	Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving	Forest management
9,166	43,669	24,517	1,315	68,718	-
9,031	43,450	24,300	1,051	68,373	-
192	304	217	378	478	-
4,662	4,468	2,557	576	7,029	-
4,178	38,678	21,526	96	60,866	-
0.52	0.86	0.49	0.22	1.36	0.00
0.72	1.73	0.96	0.01	0.83	-
1.42	8.27	4.34	0.13	11.72	-
2.22	16.64	9.29	0.09	7.98	-
0.23	1.18	0.66	0.01	0.45	-
0.21	1.14	0.63	0.01	0.13	-
0.52	0.19	0.12	0.05	0.31	-
0.09	0.85	0.47	0.00	0.01	-
0.04	0.24	0.13	0.00	0.02	-
1.22	4.12	2.31	0.16	6.43	-
0.17	0.08	0.05	0.00	0.02	-
584	3,347	1,872	80	5,275	-
589	3,365	1,882	80	5,296	-
672	3,511	1,964	85	5,493	-
0.014	0.104	0.057	0.001	0.181	-
0.021	0.070	0.040	0.007	0.660	-
0.044	0.107	0.061	0.014	0.513	-
0.004	0.018	0.010	0.002	0.047	-
0.003	0.016	0.009	0.001	0.028	-
0.020	0.038	0.023	0.014	0.062	-
0.000	0.002	0.001	0.000	0.003	-
0.001	0.003	0.002	0.000	0.005	-
TN					GA
NC					

CO2 Transportation	CO2 Capture	CO2 Transportation	CO2 Capture	CO2 Transportation	CO2 Capture
7.77	1,356.35	7.77	1,356.35	7.77	1,356.35
	0.037		0.037		0.037
	1.603		1.603		1.603
	0.000		0.000		0.000
	0.061		0.061		0.061
	0.000		0.000		0.000
	0.000		0.000		0.000
	0.000		0.000		0.000
	0.000		0.000		0.000
	0.087		0.087		0.087
	0.559		0.559		0.559
8	6,782	8	6,816	8	6,757
0	190	0	220	0	167
0	5	0	5	0	3
0	76	0	86	0	73
0	109	0	129	0	91
0.00	0.17	0.00	0.17	0.00	0.17
0.000	0.025	0.000	0.028	0.000	0.024
0.000	0.540	0.000	0.529	0.000	0.521
0.000	0.313	0.000	0.335	0.000	0.310
0.000	0.033	0.000	0.034	0.000	0.032
0.000	0.030	0.000	0.032	0.000	0.030
0.000	0.053	0.000	0.054	0.000	0.053
0.000	0.005	0.000	0.006	0.000	0.005
0.000	0.010	0.000	0.010	0.000	0.010
0.000	0.071	0.000	0.074	0.000	0.068
0.000	0.025	0.000	0.026	0.000	0.025
0.000	12.571	0.000	14.672	0.000	10.735
0.000	0.074	0.000	0.074	0.000	0.074
0.000	0.007	0.000	0.007	0.000	0.007

0.000	0.005	0.000	0.005	0.000	0.004
0.000	0.001	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.001	0.000	0.001	0.000	0.001
0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000

	MN				
	Total		Urban		Total
Fuel	Feedstock	Fuel	Feedstock	Fuel	Feedstock
	142,276	4,854,745			83,690
	138,484	0			79,152
	1,884	0			2,981
	15,391	0			11,204
	121,210	0			64,967
	2.97	118.00			2.14
0.128	4.59	9.82	0.332	0.128	2.01
4.735	24.56	364.21	0.480	4.735	14.31
2.719	44.39	209.15	0.522	2.719	19.08
0.294	3.09	22.62	0.070	0.294	1.31
0.276	2.84	21.22	0.054	0.276	1.09
0.489	0.82	37.61	0.154	0.489	0.73
0.038	2.08	2.93	0.006	0.038	0.75
0.090	0.60	6.92	0.010	0.090	0.23
	13.28	34.81			7.90
	0.23	18.53			0.11
	10,669	-699			6,092
	10,722	-96			6,121
	11,181	6,000			6,386

Material Inputs

[illegible]

	0.000	0.000	0.000	0.000	0.000	0.000
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ton,dry)	Lumber Mill Operations Allocated to Sawdust/Shavings (per ton, dry)					Operations within power plant
NE/NC	PNW	INW	SE	NE/NC (SW)	NE/NC (HW)	
0%	0%	0%	0%	0%	0%	

						Receiving & Handling
57,241	14,811	31,623	22,747	26,635	43,205	-
47,688	12,046	25,812	18,211	22,126	36,375	-
13,689	3,961	8,320	6,500	6,463	9,785	-
21,692	6,146	13,085	9,925	10,205	15,792	-
12,308	1,940	4,407	1,786	5,458	10,798	-
5	2	3	4	2	3	-
0.86	0.18	0.40	0.26	0.39	0.82	-
4.14	0.88	2.49	2.63	1.88	8.44	-
7.08	1.35	2.96	1.55	3.19	5.68	-
0.65	0.14	0.30	0.18	0.29	0.50	-
0.51	0.10	0.22	0.12	0.23	0.40	-
1.72	0.49	1.04	0.80	0.81	1.24	-
0.27	0.04	0.09	0.03	0.12	0.22	-
0.12	0.02	0.05	0.03	0.05	0.10	-
6.74	1.79	3.81	2.79	3.15	5.04	-
0.08	0.02	0.04	0.03	0.04	0.06	-
3,632	915	1,960	1,380	1,685	2,763	-
0.054	0.011	0.026	0.019	0.025	0.056	-
0.263	0.073	0.155	0.118	0.124	0.192	-
0.536	0.151	0.318	0.245	0.252	0.389	-
0.063	0.017	0.037	0.028	0.030	0.046	-
0.053	0.015	0.031	0.024	0.025	0.039	-
0.513	0.147	0.310	0.241	0.242	0.369	-
0.003	0.001	0.002	0.001	0.001	0.002	-
0.014	0.004	0.008	0.006	0.007	0.010	-

			AZ			
HW Mill residues	SW Mill chips	Pellets	SW Pulp Logs	HW Pulp Logs	SW LogRes	HW LogRes
Truck	Truck	Truck	Truck	Truck	Truck	Truck
5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
157.2	-	153.2	60.4	94.1	64.4	67.2
100%	100%	100%	100%	100%	100%	100%

1180	1417	1032	1121	1290	1357	1357
936	1125	819	890	1024	1077	1077
392,735	-	334,819	143,317	257,133	185,143	193,125
390,765	-	333,139	142,598	255,843	184,214	192,156
2,734	-	2,331	998	1,790	1,289	1,344
40,171	-	34,247	14,659	26,301	18,937	19,754
347,860	-	296,562	126,941	227,752	163,988	171,058
8	-	7	3	5	4	4
4.748	-	4.048	1.733	3.108	2.238	2.335
66.982	-	57.105	24.443	43.855	31.577	32.938
45.614	-	38.887	16.645	29.865	21.503	22.430
2.546	-	2.171	0.929	1.667	1.200	1.252
0.725	-	0.618	0.265	0.475	0.342	0.357
1.765	-	1.505	0.644	1.156	0.832	0.868
0.068	-	0.058	0.025	0.044	0.032	0.033
0.121	-	0.103	0.044	0.079	0.057	0.059
36.742	-	31.323	13.408	24.056	17.321	18.067
0.119	-	0.102	0.044	0.078	0.056	0.059
30147	0	25701	11001	19738	14212	14824
1.034	-	0.882	0.377	0.677	0.488	0.509
3.775	-	3.218	1.377	2.471	1.779	1.856
2.932	-	2.500	1.070	1.920	1.382	1.442
0.271	-	0.231	0.099	0.177	0.128	0.133
0.160	-	0.136	0.058	0.105	0.075	0.079
0.352	-	0.300	0.128	0.230	0.166	0.173
0.019	-	0.016	0.007	0.012	0.009	0.009
0.026	-	0.022	0.010	0.017	0.012	0.013

LA		
Urban	Total	Urban
0.000	0.034	0.000
0.016	1.243	0.016
0.009	0.714	0.009
0.001	0.077	0.001
0.001	0.072	0.001
0.002	0.128	0.002
0.000	0.010	0.000
0.000	0.024	0.000
	0.119	
	0.063	
	-2	

LA		
Urban	Total	Urban
	4,854,745	
0.128	9.824	0.128
4.735	364.205	4.735
2.719	209.152	2.719
0.294	22.624	0.294
0.276	21.220	0.276
0.489	37.613	0.489
0.038	2.928	0.038
0.090	6.918	0.090
	34.807	
	18.528	
	-699	

MN				IN		
Tree Harvest or Residue Collection	Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving	Forest management	Tree Harvest or Residue Collection	Biomass Processing
82,095	26,909	2,750	30,522	-	22,426	16,474
81,683	24,123	2,309	30,369	-	22,313	13,750
572	468	632	212	-	156	395
8,397	2,857	1,015	3,122	-	2,294	1,789
72,715	20,798	663	27,034	-	19,863	11,566
1.62	0.55	0.20	0.60	0.00	0.44	0.34
3.23	0.93	0.05	0.37	-	0.88	0.52
14.65	4.24	0.47	5.21	-	4.06	2.38
31.33	9.15	0.35	3.54	-	8.56	5.18
2.22	0.64	0.03	0.20	-	0.61	0.36
2.14	0.62	0.03	0.06	-	0.58	0.35
0.36	0.24	0.08	0.14	-	0.10	0.20
1.60	0.46	0.01	0.01	-	0.44	0.26
0.46	0.13	0.01	0.01	-	0.12	0.07
7.74	2.36	0.32	2.86	-	2.11	1.38
0.16	0.06	0.00	0.01	-	0.04	0.04
6,294	1,858	175	2,343	-	1,719	1,058
6,327	1,867	176	2,352	-	1,728	1,064
6,600	1,954	187	2,440	-	1,803	1,116
0.193	0.056	0.003	0.080	-	0.053	0.031
0.132	0.043	0.012	0.293	-	0.036	0.026
0.200	0.069	0.025	0.228	-	0.055	0.043
0.035	0.011	0.003	0.021	-	0.009	0.007
0.030	0.010	0.002	0.012	-	0.008	0.006
0.072	0.032	0.024	0.027	-	0.020	0.023
0.004	0.001	0.000	0.001	-	0.001	0.001
0.005	0.002	0.001	0.002	-	0.001	0.001

LA

CO2 Transportation	CO2 Capture	CO2 Transportation
7.77	1,356.35	7.77
	0.037	
	1.603	
	0.000	
	0.061	
	0.000	
	0.000	
	0.000	
	0.000	
	0.087	
	0.559	
8	6,722	8
0	131	0
0	3	0
0	69	0
0	59	0
0.00	0.17	0.00
0.000	0.023	0.000
0.000	0.515	0.000
0.000	0.298	0.000
0.000	0.032	0.000
0.000	0.029	0.000
0.000	0.052	0.000
0.000	0.004	0.000
0.000	0.010	0.000
0.000	0.065	0.000
0.000	0.025	0.000
0.000	8.063	0.000
0.000	0.074	0.000
0.000	0.007	0.000

0.000	0.004	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.001	0.000
0.000	0.000	0.000
0.000	0.000	0.000

IN			NY			
	Urban		Total		Urban	
Fuel	Feedstock	Fuel	Feedstock	Fuel	Feedstock	Fuel
4,854,745			80,794	4,854,745		
0			79,054	0		
0			2,477	0		
0			10,559	0		
0			66,017	0		
122.86			2.02	123.90		
9.82	0.189	0.128	2.21	9.82	0.189	0.128
364.21	0.443	4.735	14.33	364.21	0.387	4.735
209.15	0.447	2.719	20.92	209.15	0.401	2.719
22.62	0.051	0.294	1.45	22.62	0.047	0.294
21.22	0.037	0.276	1.25	21.22	0.035	0.276
37.61	0.156	0.489	0.57	37.61	0.138	0.489
2.93	0.004	0.038	0.89	2.93	0.004	0.038
6.92	0.007	0.090	0.27	6.92	0.007	0.090
34.81			7.79	34.81		
18.53			0.10	18.53		
-699			6,086	-699		
-96			6,115	-96		
6,000			6,375	6,000		

[illegible]

0.000

0.000

SW Mill residues	HW Mill residues	SW Mill chips	Pellets	SW Pulp Logs	HW Pulp Logs	SW LogRes
Truck	Truck	Truck	Truck	Truck	Truck	Truck
5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
192.0	-	139.0	168.2	33.4	31.0	34.9
100%	100%	100%	100%	100%	100%	100%

1386	1386	1765	1032	1243	1341	1357
1100	1100	1401	819	987	1064	1077
563,641	-	519,583	367,686	87,993	87,967	100,137
560,813	-	516,977	365,841	87,551	87,526	99,635
3,924	-	3,617	2,560	613	612	697
57,652	-	53,145	37,609	9,000	8,998	10,243
499,238	-	460,214	325,673	77,938	77,916	88,695
11	-	10	7	2	2	2
6.814	-	6.281	4.445	1.064	1.063	1.211
96.131	-	88.617	62.710	15.007	15.003	17.079
65.464	-	60.347	42.705	10.220	10.217	11.630
3.654	-	3.369	2.384	0.570	0.570	0.649
1.041	-	0.959	0.679	0.162	0.162	0.185
2.533	-	2.335	1.652	0.395	0.395	0.450
0.097	-	0.090	0.063	0.015	0.015	0.017
0.174	-	0.160	0.113	0.027	0.027	0.031
52.730	-	48.609	34.398	8.232	8.230	9.368
0.171	-	0.158	0.112	0.027	0.027	0.030
43266	0	39884	28224	6754	6752	7687
1.485	-	1.369	0.968	0.232	0.232	0.264
5.417	-	4.994	3.534	0.846	0.845	0.962
4.208	-	3.879	2.745	0.657	0.657	0.748
0.389	-	0.358	0.254	0.061	0.061	0.069
0.230	-	0.212	0.150	0.036	0.036	0.041
0.504	-	0.465	0.329	0.079	0.079	0.090
0.027	-	0.025	0.017	0.004	0.004	0.005
0.038	-	0.035	0.025	0.006	0.006	0.007

		NY				
Shared of Lumber Mill Operations	Transportation & receiving	Forest management	Tree Harvest or Residue Collection	Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving
9,644	35,146	-	28,726	14,240	8,718	29,110
8,118	34,969	-	28,582	14,169	7,339	28,964
2,185	245	-	200	99	1,975	203
3,526	3,595	-	2,938	1,457	3,187	2,977
2,408	31,130	-	25,444	12,613	2,177	25,784
0.66	0.69	0.00	0.57	0.28	0.60	0.57
0.18	0.42	-	1.13	0.56	0.16	0.35
1.88	5.99	-	5.12	2.54	1.70	4.96
1.27	4.08	-	10.96	5.43	1.14	3.38
0.11	0.23	-	0.78	0.38	0.10	0.19
0.09	0.06	-	0.75	0.37	0.08	0.05
0.28	0.16	-	0.13	0.06	0.25	0.13
0.05	0.01	-	0.56	0.28	0.04	0.01
0.02	0.01	-	0.16	0.08	0.02	0.01
1.12	3.29	-	2.71	1.34	1.02	2.72
0.01	0.01	-	0.05	0.03	0.01	0.01
617	2,698	-	2,202	1,092	557	2,235
620	2,709	-	2,214	1,097	561	2,243
657	2,809	-	2,309	1,145	594	2,327
0.012	0.093	-	0.067	0.033	0.011	0.077
0.043	0.338	-	0.046	0.023	0.039	0.280
0.087	0.262	-	0.070	0.035	0.079	0.217
0.010	0.024	-	0.012	0.006	0.009	0.020
0.009	0.014	-	0.010	0.005	0.008	0.012
0.082	0.031	-	0.025	0.012	0.074	0.026
0.000	0.002	-	0.001	0.001	0.000	0.001
0.002	0.002	-	0.002	0.001	0.002	0.002

ME				TN			
Total		Urban		Total		Urban	
Feedstock	Fuel	Feedstock	Fuel	Feedstock	Fuel	Feedstock	
113,432	4,854,745			99,395	4,854,745		
112,124	0			96,663	0		
1,558	0			3,312	0		
12,500	0			13,291	0		
98,067	0			80,060	0		
2.43	123.90			2.55	123.90		
3.28	9.82	0.273	0.128	2.37	9.82		0.260
19.61	364.21	0.515	4.735	27.99	364.21		0.639
31.64	209.15	0.502	2.719	19.54	209.15		0.602
2.18	22.62	0.061	0.294	1.31	22.62		0.065
1.92	21.22	0.045	0.276	0.99	21.22		0.045
0.60	37.61	0.126	0.489	0.75	37.61		0.180
1.38	2.93	0.005	0.038	0.64	2.93		0.005
0.40	6.92	0.008	0.090	0.22	6.92		0.009
10.72	34.81			9.57	34.81		
0.15	18.53			0.09	18.53		
8,640	-699			7,423	-699		
8,681	-96			7,475	-96		
9,042	6,000			7,785	6,000		

MN						
HW LogRes	SW Mill residues	HW Mill residues	SW Mill chips	Pellets	SW Pulp Logs	HW Pulp Logs
Truck	Truck	Truck	Truck	Truck	Truck	Truck
5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
34.7	28.9	53.0	-	22.0	50.3	41.0
100%	100%	100%	100%	100%	100%	100%

1357	1326	1326	1403	1032	1085	1200
1077	1053	1053	1113	819	861	952
99,763	81,239	149,000	-	48,191	115,505	104,158
99,262	80,831	148,253	-	47,949	114,925	103,636
695	566	1,037	-	335	804	725
10,204	8,309	15,240	-	4,929	11,814	10,654
88,364	71,956	131,975	-	42,685	102,307	92,257
2	2	3	-	1	2	2
1.206	0.982	1.801	-	0.583	1.396	1.259
17.015	13.856	25.412	-	8.219	19.700	17.765
11.587	9.435	17.306	-	5.597	13.415	12.097
0.647	0.527	0.966	-	0.312	0.749	0.675
0.184	0.150	0.275	-	0.089	0.213	0.192
0.448	0.365	0.670	-	0.217	0.519	0.468
0.017	0.014	0.026	-	0.008	0.020	0.018
0.031	0.025	0.046	-	0.015	0.036	0.032
9.333	7.600	13.939	-	4.508	10.806	9.744
0.030	0.025	0.045	-	0.015	0.035	0.032
7658	6236	11437	0	3699	8866	7995
0.263	0.214	0.392	-	0.127	0.304	0.274
0.959	0.781	1.432	-	0.463	1.110	1.001
0.745	0.607	1.113	-	0.360	0.862	0.778
0.069	0.056	0.103	-	0.033	0.080	0.072
0.041	0.033	0.061	-	0.020	0.047	0.042
0.089	0.073	0.133	-	0.043	0.103	0.093
0.005	0.004	0.007	-	0.002	0.005	0.005
0.007	0.005	0.010	-	0.003	0.008	0.007

ME						
Forest management	Tree Harvest or Residue Collection	Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving	Forest management	Tree Harvest or Residue Collection
-	47,263	22,555	3,207	40,406	-	20,544
-	47,026	22,222	2,672	40,204	-	20,440
-	329	180	767	281	-	144
-	4,834	2,316	1,217	4,133	-	2,127
-	41,863	19,726	689	35,789	-	18,169
0.00	0.93	0.45	0.25	0.80	0.00	0.41
-	1.86	0.88	0.05	0.49	-	1.05
-	8.43	3.98	0.31	6.89	-	14.50
-	18.04	8.52	0.39	4.69	-	7.31
-	1.28	0.60	0.04	0.26	-	0.51
-	1.23	0.58	0.03	0.07	-	0.49
-	0.21	0.11	0.10	0.18	-	0.09
-	0.92	0.43	0.01	0.01	-	0.36
-	0.26	0.12	0.01	0.01	-	0.11
-	4.46	2.11	0.38	3.78	-	1.94
-	0.09	0.04	0.00	0.01	-	0.04
-	3,623	1,712	203	3,102	-	1,556
-	3,642	1,721	204	3,114	-	1,582
-	3,800	1,796	216	3,230	-	1,650
-	0.111	0.052	0.003	0.106	-	0.073
-	0.076	0.036	0.015	0.388	-	0.035
-	0.115	0.055	0.030	0.302	-	0.053
-	0.020	0.009	0.004	0.028	-	0.009
-	0.017	0.008	0.003	0.016	-	0.008
-	0.041	0.020	0.029	0.036	-	0.019
-	0.002	0.001	0.000	0.002	-	0.001
-	0.003	0.001	0.001	0.003	-	0.001

	NC				G	
	Total		Urban		Total	
Fuel	Feedstock	Fuel	Feedstock	Fuel	Feedstock	Fuel
	124,217	4,854,745			80,604	4,854,745
	118,587	0			79,260	0
	3,482	0			1,910	0
	20,600	0			11,011	0
	94,506	0			66,339	0
	3.41	123.90			2.36	123.90
0.128	4.43	9.82	0.265	0.128	1.99	9.82
4.735	19.92	364.21	0.408	4.735	13.93	364.21
2.719	36.12	209.15	0.507	2.719	17.40	209.15
0.294	2.64	22.62	0.064	0.294	1.19	22.62
0.276	2.41	21.22	0.051	0.276	0.94	21.22
0.489	1.63	37.61	0.209	0.489	0.66	37.61
0.038	1.66	2.93	0.006	0.038	0.62	2.93
0.090	0.50	6.92	0.010	0.090	0.20	6.92
	12.18	34.81			7.82	34.81
	0.43	18.53			0.13	18.53
	8,972	-699			6,070	-699
	9,017	-96			6,098	-96
	9,498	6,000			6,367	6,000

IN						
SW LogRes	HW LogRes	SW Mill residues	HW Mill residues	SW Mill chips	Pellets	SW Pulp Logs
Truck	Truck	Truck	Truck	Truck	Truck	Truck
5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
54.6	24.3	73.5	43.3	-	37.4	41.6
100%	100%	100%	100%	100%	100%	100%

1357 1077	1357 1077	1326 1053	1326 1053	1403 1113	1032 819	1266 1005
156,909	69,953	206,405	121,495	-	81,855	111,534
156,122	69,602	205,369	120,886	-	81,444	110,974
1,092	487	1,437	846	-	570	776
16,049	7,155	21,112	12,427	-	8,372	11,408
138,981	61,960	182,820	107,613	-	72,502	98,789
3	1	4	2	-	2	2
1.897	0.846	2.495	1.469	-	0.990	1.348
26.761	11.931	35.203	20.721	-	13.961	19.022
18.224	8.125	23.973	14.111	-	9.507	12.954
1.017	0.454	1.338	0.788	-	0.531	0.723
0.290	0.129	0.381	0.224	-	0.151	0.206
0.705	0.314	0.928	0.546	-	0.368	0.501
0.027	0.012	0.036	0.021	-	0.014	0.019
0.048	0.022	0.064	0.037	-	0.025	0.034
14.679	6.544	19.310	11.366	-	7.658	10.434
0.048	0.021	0.063	0.037	-	0.025	0.034
12045	5370	15844	9326	0	6283	8561
0.413	0.184	0.544	0.320	-	0.216	0.294
1.508	0.672	1.984	1.168	-	0.787	1.072
1.172	0.522	1.541	0.907	-	0.611	0.833
0.108	0.048	0.142	0.084	-	0.056	0.077
0.064	0.029	0.084	0.050	-	0.033	0.045
0.140	0.063	0.185	0.109	-	0.073	0.100
0.007	0.003	0.010	0.006	-	0.004	0.005
0.011	0.005	0.014	0.008	-	0.005	0.007

TN			NC			
Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving	Forest management	Tree Harvest or Residue Collection	Biomass Processing	Shared of Lumber Mill Operations
12,801	10,487	55,563	13,023	54,847	34,614	143
12,118	8,821	55,284	12,832	54,572	29,588	114
395	2,387	387	273	382	2,636	41
1,635	3,846	5,683	6,623	5,610	6,096	62
10,089	2,588	49,214	5,936	48,580	20,856	11
0.31	0.73	1.10	0.75	1.08	1.13	0.02
0.46	0.19	0.67	1.03	2.16	0.98	0.00
2.06	1.96	9.48	2.02	9.78	4.42	0.02
4.41	1.37	6.45	3.16	20.93	9.51	0.01
0.31	0.12	0.36	0.33	1.48	0.69	0.00
0.30	0.10	0.10	0.29	1.43	0.64	0.00
0.11	0.30	0.25	0.74	0.24	0.54	0.01
0.22	0.05	0.01	0.13	1.07	0.46	0.00
0.06	0.02	0.02	0.05	0.30	0.14	0.00
1.20	1.22	5.20	1.74	5.17	3.24	0.02
0.03	0.01	0.02	0.25	0.10	0.07	0.00
933	670	4,265	830	4,205	2,272	9
937	674	4,282	836	4,227	2,282	9
980	714	4,442	955	4,409	2,399	9
0.027	0.013	0.146	0.020	0.129	0.059	0.000
0.024	0.047	0.534	0.030	0.088	0.082	0.001
0.039	0.095	0.415	0.062	0.134	0.149	0.002
0.006	0.011	0.038	0.006	0.023	0.020	0.000
0.005	0.009	0.023	0.005	0.020	0.017	0.000
0.022	0.090	0.050	0.029	0.048	0.112	0.002
0.001	0.001	0.003	0.001	0.003	0.001	0.000
0.001	0.002	0.004	0.001	0.004	0.004	0.000

A		LA				
Urban		Total		Urban		Total
Feedstock	Fuel	Feedstock	Fuel	Feedstock	Fuel	Feedstock
		54,810	4,854,745			46,638
		53,246	0			45,744
		2,231	0			1,272
		7,822	0			5,909
		43,192	0			38,563
		2.02	123.90			1.35
0.193	0.128	0.89	9.82	0.130	0.128	1.22
0.494	4.735	9.05	364.21	0.430	4.735	7.74
0.460	2.719	8.28	209.15	0.389	2.719	11.68
0.049	0.294	0.54	22.62	0.039	0.294	0.80
0.034	0.276	0.33	21.22	0.026	0.276	0.68
0.121	0.489	0.45	37.61	0.113	0.489	0.31
0.004	0.038	0.18	2.93	0.003	0.038	0.48
0.006	0.090	0.07	6.92	0.005	0.090	0.14
		5.33	34.81			4.48
		0.04	18.53			0.06
		4,100	-699			3,523
		4,117	-96			3,539
		4,285	6,000			3,688

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1140	1357	1357	1326	1326	1403	1032	1221	1159
904	1077	1077	1053	1053	1113	819	969	920
104,748	-	-	147,002	87,754	-	-	106,935	89,066
104,222	-	-	146,264	87,314	-	-	106,399	88,620
729	-	-	1,023	611	-	-	744	620
10,714	-	-	15,036	8,976	-	-	10,938	9,110
92,779	-	-	130,205	77,727	-	-	94,716	78,889
2	-	-	3	2	-	-	2	2
1.266	-	-	1.777	1.061	-	-	1.293	1.077
17.865	-	-	25.072	14.967	-	-	18.238	15.191
12.166	-	-	17.073	10.192	-	-	12.420	10.345
0.679	-	-	0.953	0.569	-	-	0.693	0.577
0.193	-	-	0.271	0.162	-	-	0.197	0.164
0.471	-	-	0.661	0.394	-	-	0.481	0.400
0.018	-	-	0.025	0.015	-	-	0.018	0.015
0.032	-	-	0.045	0.027	-	-	0.033	0.027
9.799	-	-	13.752	8.210	-	-	10.004	8.332
0.032	-	-	0.045	0.027	-	-	0.033	0.027
8041	0	0	11284	6736	0	0	8208	6837
0.276	-	-	0.387	0.231	-	-	0.282	0.235
1.007	-	-	1.413	0.843	-	-	1.028	0.856
0.782	-	-	1.098	0.655	-	-	0.798	0.665
0.072	-	-	0.101	0.061	-	-	0.074	0.061
0.043	-	-	0.060	0.036	-	-	0.044	0.036
0.094	-	-	0.132	0.079	-	-	0.096	0.080
0.005	-	-	0.007	0.004	-	-	0.005	0.004
0.007	-	-	0.010	0.006	-	-	0.007	0.006

	GA					LA		
Transportation & receiving	Forest management	Tree Harvest or Residue Collection	Biomass Processing	Shared of Lumber Mill Operations	Transportation & receiving	Forest management	Tree Harvest or Residue Collection	Biomass Processing
21,590	2,952	15,091	14,668	4,689	43,203	-	-	8,416
21,481	2,909	15,015	14,595	3,754	42,986	-	-	8,374
150	62	105	102	1,340	301	-	-	59
2,208	1,502	1,544	1,500	2,046	4,419	-	-	861
19,123	1,346	13,366	12,992	368	38,267	-	-	7,454
0.43	0.17	0.30	0.29	0.75	0.85	0.00	0.00	0.17
0.26	0.23	0.60	0.58	0.05	0.52	-	-	0.33
3.68	0.46	2.94	2.62	0.54	7.37	-	-	1.50
2.51	0.72	5.75	5.60	0.32	5.02	-	-	3.21
0.14	0.07	0.41	0.40	0.04	0.28	-	-	0.23
0.04	0.07	0.39	0.38	0.02	0.08	-	-	0.22
0.10	0.17	0.07	0.06	0.17	0.19	-	-	0.04
0.00	0.03	0.29	0.29	0.01	0.01	-	-	0.16
0.01	0.01	0.08	0.08	0.01	0.01	-	-	0.05
2.02	0.39	1.42	1.38	0.57	4.04	-	-	0.79
0.01	0.06	0.03	0.03	0.01	0.01	-	-	0.02
1,657	188	1,156	1,125	284	3,316	-	-	645
1,664	190	1,163	1,130	285	3,330	-	-	649
1,726	216	1,213	1,179	304	3,454	-	-	677
0.057	0.005	0.036	0.034	0.004	0.114	-	-	0.020
0.207	0.007	0.024	0.024	0.024	0.415	-	-	0.013
0.161	0.014	0.037	0.036	0.050	0.323	-	-	0.021
0.015	0.001	0.006	0.006	0.006	0.030	-	-	0.004
0.009	0.001	0.005	0.005	0.005	0.018	-	-	0.003
0.019	0.007	0.013	0.013	0.050	0.039	-	-	0.007
0.001	0.000	0.001	0.001	0.000	0.002	-	-	0.000
0.001	0.000	0.001	0.001	0.001	0.003	-	-	0.001

WA biopower w/ CCS					CA biopower w/ CCS				
		Urban			Total			Urban	
Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	
4,854,745	3,188,601				92,456	4,854,745	3,213,890		
0	57,509				91,433	0	86,804		
0	972				1,445	0	1,082		
0	31,304				10,420	0	34,163		
0	25,233				79,568	0	51,559		
123.90	80.99				2.19	123.90	81.43		
9.82	10.99	0.11	0.13	35.19	2.12	9.82	11.55	0.23	
364.21	243.42	0.24	4.73	3.27	15.71	364.21	248.22	0.58	
209.15	143.44	0.24	2.72	1.99	20.37	209.15	148.84	0.52	
22.62	15.12	0.03	0.29	0.21	1.36	22.62	15.46	0.06	
21.22	14.14	0.02	0.28	0.20	1.07	21.22	14.37	0.04	
37.61	24.78	0.07	0.49	0.37	0.50	37.61	24.87	0.11	
2.93	2.20	0.00	0.04	0.03	0.73	2.93	2.36	0.00	
6.92	4.56	0.00	0.09	0.06	0.22	6.92	4.61	0.01	
34.81	30.23				8.76	34.81	32.94		
18.53	12.00				0.09	18.53	12.00		
-699	-474,385				7,047	-699	-473,653		
-96	-473,969				7,079	-96	-473,969		
6,000	-469,793				7,364	6,000	-469,793		

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1357 1077	1357 1077	1326 1053	1326 1053	1403 1113	1032 819	1221 969	1200 952	1357 1077
149,104	150,734	168,438	156,063	-	49,350	145,797	120,495	58,556
148,356	149,977	167,593	155,280	-	49,102	145,066	119,890	58,263
1,038	1,049	1,173	1,086	-	344	1,015	839	408
15,251	15,418	17,229	15,963	-	5,048	14,913	12,325	5,989
132,067	133,510	149,192	138,231	-	43,711	129,138	106,727	51,866
3	3	3	3	-	1	3	2	1
1.802	1.822	2.036	1.887	-	0.597	1.763	1.457	0.708
25.430	25.708	28.728	26.617	-	8.417	24.866	20.551	9.987
17.318	17.507	19.563	18.126	-	5.732	16.934	13.995	6.801
0.967	0.977	1.092	1.012	-	0.320	0.945	0.781	0.380
0.275	0.278	0.311	0.288	-	0.091	0.269	0.222	0.108
0.670	0.677	0.757	0.701	-	0.222	0.655	0.542	0.263
0.026	0.026	0.029	0.027	-	0.009	0.025	0.021	0.010
0.046	0.046	0.052	0.048	-	0.015	0.045	0.037	0.018
13.949	14.102	15.758	14.600	-	4.617	13.640	11.273	5.478
0.045	0.046	0.051	0.047	-	0.015	0.044	0.037	0.018
11445	11570	12929	11980	0	3788	11192	9249	4495
0.393	0.397	0.444	0.411	-	0.130	0.384	0.317	0.154
1.433	1.449	1.619	1.500	-	0.474	1.401	1.158	0.563
1.113	1.125	1.258	1.165	-	0.368	1.089	0.900	0.437
0.103	0.104	0.116	0.108	-	0.034	0.101	0.083	0.040
0.061	0.061	0.069	0.064	-	0.020	0.059	0.049	0.024
0.133	0.135	0.151	0.140	-	0.044	0.130	0.108	0.052
0.007	0.007	0.008	0.007	-	0.002	0.007	0.006	0.003
0.010	0.010	0.011	0.010	-	0.003	0.010	0.008	0.004

Shared of Lumber Mill Operations	Transportation & receiving
6,635	39,760
5,312	39,560
1,896	277
2,895	4,067
521	35,217
1.06	0.78
0.08	0.48
0.77	6.78
0.45	4.62
0.05	0.26
0.03	0.07
0.23	0.18
0.01	0.01
0.01	0.01
0.81	3.72
0.01	0.01
402	3,052
404	3,064
430	3,178
0.005	0.105
0.035	0.382
0.071	0.297
0.008	0.027
0.007	0.016
0.070	0.036
0.000	0.002
0.002	0.003

		ID biopower w/ CCS							
		Total			Urban			Total	
Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	
		119,505	4,854,745	3,276,745					147,385
		116,533	0	104,388					146,205
		2,177	0	1,575					1,570
		13,724	0	36,797					19,292
		100,632	0	66,016					125,344
		2.72	123.90	82.91					3.45
0.13	35.22	3.26	9.82	12.47	0.28	0.13	35.76		4.26
4.73	3.48	20.49	364.21	254.83	0.57	4.73	3.53		25.88
2.72	2.16	31.41	209.15	158.13	0.56	2.72	2.22		36.22
0.29	0.23	2.15	22.62	16.20	0.07	0.29	0.24		2.52
0.28	0.21	1.86	21.22	15.09	0.05	0.28	0.22		2.11
0.49	0.40	0.74	37.61	25.37	0.15	0.49	0.43		1.19
0.04	0.03	1.33	2.93	2.78	0.01	0.04	0.03		1.43
0.09	0.06	0.39	6.92	4.78	0.01	0.09	0.07		0.44
		11.25	34.81	35.03					14.24
		0.16	18.53	12.21					0.33
		8,978	-699	-480,255					11,158
		9,020	-96	-473,969					11,211
		9,398	6,000	-469,793					11,725

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1357	1539	1539	1896	1032	1243	1243	1357	1357
1077	1222	1222	1504	819	987	987	1077	1077
76,802	226,027	192,890	-	174,904	73,211	-	-	-
76,417	224,894	191,922	-	174,027	72,843	-	-	-
535	1,574	1,343	-	1,218	510	-	-	-
7,856	23,119	19,730	-	17,890	7,488	-	-	-
68,026	200,201	170,850	-	154,919	64,845	-	-	-
2	4	4	-	3	1	-	-	-
0.928	2.732	2.332	-	2.114	0.885	-	-	-
13.099	38.550	32.898	-	29.830	12.486	-	-	-
8.920	26.252	22.403	-	20.314	8.503	-	-	-
0.498	1.465	1.251	-	1.134	0.475	-	-	-
0.142	0.417	0.356	-	0.323	0.135	-	-	-
0.345	1.016	0.867	-	0.786	0.329	-	-	-
0.013	0.039	0.033	-	0.030	0.013	-	-	-
0.024	0.070	0.059	-	0.054	0.023	-	-	-
7.185	21.146	18.045	-	16.363	6.849	-	-	-
0.023	0.069	0.059	-	0.053	0.022	-	-	-
5895	17350	14806	0	13426	5620	0	0	0
0.202	0.595	0.508	-	0.461	0.193	-	-	-
0.738	2.172	1.854	-	1.681	0.704	-	-	-
0.573	1.688	1.440	-	1.306	0.547	-	-	-
0.053	0.156	0.133	-	0.121	0.051	-	-	-
0.031	0.092	0.079	-	0.071	0.030	-	-	-
0.069	0.202	0.173	-	0.157	0.066	-	-	-
0.004	0.011	0.009	-	0.008	0.003	-	-	-
0.005	0.015	0.013	-	0.012	0.005	-	-	-

AZ biopower w/ CCS					MN biopower w/ CCS				
		Urban			Total			Urban	
Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	
4,854,745	3,280,623				142,276	4,854,745	3,346,259		
0	123,193				138,484	0	120,668		
0	1,174				1,884	0	1,407		
0	40,251				15,391	0	38,513		
0	81,768				121,210	0	80,749		
123.90	83.03				2.97	118.00	80.54		
9.82	13.06	0.36	0.13	35.65	4.59	9.82	13.55	0.33	
364.21	257.22	0.80	4.73	3.66	24.56	364.21	261.76	0.48	
209.15	160.57	0.74	2.72	2.33	44.39	209.15	169.36	0.52	
22.62	16.37	0.08	0.29	0.25	3.09	22.62	17.09	0.07	
21.22	15.18	0.06	0.28	0.23	2.84	21.22	15.99	0.05	
37.61	25.55	0.16	0.49	0.43	0.82	37.61	25.85	0.15	
2.93	2.83	0.01	0.04	0.03	2.08	2.93	3.33	0.01	
6.92	4.79	0.01	0.09	0.07	0.60	6.92	5.00	0.01	
34.81	36.81				13.28	34.81	36.95		
18.53	12.27				0.23	18.53	12.47		
-699	-478,100				10,669	-699	-488,175		
-96	-473,969				10,722	-96	-473,969		
6,000	-469,793				11,181	6,000	-469,793		

[illegible]

1539	1539	1896	1032	1221	1221	1357	1357	1539
1222	1222	1504	819	969	969	1077	1077	1222
-	-	-	111,060	103,997	118,530	57,677	67,716	165,053
-	-	-	110,503	103,475	117,935	57,388	67,376	164,225
-	-	-	773	724	825	402	471	1,149
-	-	-	11,360	10,637	12,124	5,899	6,926	16,882
-	-	-	98,370	92,114	104,986	51,087	59,978	146,193
-	-	-	2	2	2	1	1	3
-	-	-	1.343	1.257	1.433	0.697	0.819	1.995
-	-	-	18.942	17.737	20.216	9.837	11.549	28.150
-	-	-	12.899	12.079	13.767	6.699	7.865	19.170
-	-	-	0.720	0.674	0.768	0.374	0.439	1.070
-	-	-	0.205	0.192	0.219	0.106	0.125	0.305
-	-	-	0.499	0.467	0.533	0.259	0.304	0.742
-	-	-	0.019	0.018	0.020	0.010	0.012	0.028
-	-	-	0.034	0.032	0.037	0.018	0.021	0.051
-	-	-	10.390	9.729	11.089	5.396	6.335	15.441
-	-	-	0.034	0.032	0.036	0.018	0.021	0.050
0	0	0	8525	7983	9098	4427	5198	12670
-	-	-	0.293	0.274	0.312	0.152	0.178	0.435
-	-	-	1.067	1.000	1.139	0.554	0.651	1.586
-	-	-	0.829	0.776	0.885	0.431	0.506	1.232
-	-	-	0.077	0.072	0.082	0.040	0.047	0.114
-	-	-	0.045	0.042	0.048	0.024	0.028	0.067
-	-	-	0.099	0.093	0.106	0.052	0.061	0.148
-	-	-	0.005	0.005	0.006	0.003	0.003	0.008
-	-	-	0.007	0.007	0.008	0.004	0.005	0.011

		IN biopower w/ CCS							
		Total			Urban			Total	
Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	
		83,690	4,854,745	3,253,684				80,794	
		79,152	0	80,027				79,054	
		2,981	0	2,099				2,477	
		11,204	0	35,158				10,559	
		64,967	0	42,770				66,017	
		2.14	122.86	81.87				2.02	
0.13	36.38	2.01	9.82	11.65	0.19	0.13	35.70	2.21	
4.73	3.52	14.31	364.21	250.82	0.44	4.73	3.44	14.33	
2.72	2.23	19.08	209.15	150.11	0.45	2.72	2.15	20.92	
0.29	0.25	1.31	22.62	15.65	0.05	0.29	0.23	1.45	
0.28	0.23	1.09	21.22	14.58	0.04	0.28	0.21	1.25	
0.49	0.44	0.73	37.61	25.37	0.16	0.49	0.43	0.57	
0.04	0.03	0.75	2.93	2.40	0.00	0.04	0.03	0.89	
0.09	0.07	0.23	6.92	4.68	0.01	0.09	0.07	0.27	
		7.90	34.81	32.85				7.79	
		0.11	18.53	12.18				0.10	
		6,092	-699	-480,391				6,086	
		6,121	-96	-473,969				6,115	
		6,386	6,000	-469,793				6,375	

[illegible]

NY biopower w/ CCS					ME biopower w/ CCS				
		Urban			Total			Urban	
Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	
4,854,745	3,261,415				113,432	4,854,745	3,311,383		
0	80,199				112,124	0	102,710		
0	1,776				1,558	0	1,185		
0	34,840				12,500	0	36,424		
0	43,583				98,067	0	65,102		
123.90	82.71				2.43	123.90	83.70		
9.82	11.81	0.19	0.13	35.80	3.28	9.82	12.62	0.27	
364.21	251.58	0.39	4.73	3.41	19.61	364.21	257.26	0.51	
209.15	151.76	0.40	2.72	2.13	31.64	209.15	160.15	0.50	
22.62	15.79	0.05	0.29	0.23	2.18	22.62	16.40	0.06	
21.22	14.74	0.04	0.28	0.21	1.92	21.22	15.30	0.04	
37.61	25.34	0.14	0.49	0.42	0.60	37.61	25.58	0.13	
2.93	2.50	0.00	0.04	0.03	1.38	2.93	2.85	0.01	
6.92	4.71	0.01	0.09	0.07	0.40	6.92	4.85	0.01	
34.81	32.87				10.72	34.81	35.09		
18.53	12.22				0.15	18.53	12.35		
-699	-481,812				8,640	-699	-485,929		
-96	-473,969				8,681	-96	-473,969		
6,000	-469,793				9,042	6,000	-469,793		

SW Mill chips	Pellets
Truck	Truck
5.0%	5.0%
0.0%	0.0%
-	-
100%	100%

		TN biopower w/ CCS						
		Total			Urban			Total
Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	Fuel	CCS	Feedstock
		99,395	4,854,745	3,259,917				124,217
		96,663	0	91,330				118,587
		3,312	0	2,312				3,482
		13,291	0	36,473				20,600
		80,060	0	52,545				94,506
		2.55	123.90	82.71				3.41
0.13	36.17	2.37	9.82	11.87	0.26	0.13	35.70	4.43
4.73	3.53	27.99	364.21	259.42	0.64	4.73	3.56	19.92
2.72	2.21	19.54	209.15	150.23	0.60	2.72	2.25	36.12
0.29	0.24	1.31	22.62	15.63	0.07	0.29	0.24	2.64
0.28	0.22	0.99	21.22	14.50	0.05	0.28	0.22	2.41
0.49	0.42	0.75	37.61	25.35	0.18	0.49	0.45	1.63
0.04	0.03	0.64	2.93	2.33	0.00	0.04	0.03	1.66
0.09	0.07	0.22	6.92	4.66	0.01	0.09	0.07	0.50
		9.57	34.81	33.89				12.18
		0.09	18.53	12.16				0.43
		7,423	-699	-479,758				8,972
		7,475	-96	-473,969				9,017
		7,785	6,000	-469,793				9,498

NC biopower w/ CCS					GA biopower w/ CCS				
		Urban			Total			Urban	
Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	
4,854,745	3,251,107				80,604	4,854,745	3,228,003		
0	104,801				79,260	0	79,514		
0	2,404				1,910	0	1,391		
0	40,918				11,011	0	34,777		
0	61,479				66,339	0	43,347		
123.90	82.64				2.36	123.90	82.09		
9.82	13.11	0.27	0.13	35.43	1.99	9.82	11.55	0.19	
364.21	252.23	0.41	4.73	3.39	13.93	364.21	248.75	0.49	
209.15	159.79	0.51	2.72	2.17	17.40	209.15	147.93	0.46	
22.62	16.37	0.06	0.29	0.24	1.19	22.62	15.46	0.05	
21.22	15.31	0.05	0.28	0.22	0.94	21.22	14.39	0.03	
37.61	25.72	0.21	0.49	0.46	0.66	37.61	25.14	0.12	
2.93	2.97	0.01	0.04	0.03	0.62	2.93	2.31	0.00	
6.92	4.81	0.01	0.09	0.07	0.20	6.92	4.62	0.01	
34.81	35.32				7.82	34.81	32.55		
18.53	12.28				0.13	18.53	12.11		
-699	-476,051				6,070	-699	-476,895		
-96	-473,969				6,098	-96	-473,969		
6,000	-469,793				6,367	6,000	-469,793		

		LA biopower w/ CCS					
		Total			Urban		
Fuel	CCS	Feedstock	Fuel	CCS	Feedstock	Fuel	CCS
		54,810	4,854,745	3,206,362			
		53,246	0	62,582			
		2,231	0	1,596			
		7,822	0	32,663			
		43,192	0	28,323			
		2.02	123.90	81.74			
0.13	35.44	0.89	9.82	10.82	0.13	0.13	35.35
4.73	3.45	9.05	364.21	245.22	0.43	4.73	3.40
2.72	2.14	8.28	209.15	141.81	0.39	2.72	2.09
0.29	0.23	0.54	22.62	15.01	0.04	0.29	0.22
0.28	0.21	0.33	21.22	13.96	0.03	0.28	0.20
0.49	0.41	0.45	37.61	24.96	0.11	0.49	0.40
0.04	0.03	0.18	2.93	2.02	0.00	0.04	0.03
0.09	0.06	0.07	6.92	4.53	0.01	0.09	0.06
		5.33	34.81	30.89			
		0.04	18.53	12.03			
		4,100	-699	-476,224			
		4,117	-96	-473,969			
		4,285	6,000	-469,793			



Notice of Non-compliance 2011, No. 170 (Adj. Sess.), § 14., 10 VSA 582(g)

Pike Porter <pikeporter@gmail.com>

Fri, May 26, 2023 at 1:13 PM

To: "Moore, Julie" <Julie.Moore@vermont.gov>

Cc: ANR - Info <ANR.Info@vermont.gov>, "Hughes, Kelly" <Kelly.Hughes@vermont.gov>, "Beling, John" <John.Beling@vermont.gov>, "Schmeltzer, John" <John.Schmeltzer@vermont.gov>, "McKelvie, John" <John.McKelvie@vermont.gov>, "Tierney, June" <June.Tierney@vermont.gov>, pbaruth <pbaruth@leg.state.vt.us>, jkrowinski <jkrowinski@leg.state.vt.us>, "jim@dumontlawvt.com" <jim@dumontlawvt.com>, jane.lazorchak@vermont.gov, rachel.stevens@vermont.gov

Bcc: Zack Porter <zporter@standingtrees.org>, Ashley Adams <ashleyjaneadams@gmail.com>, Annette Smith <vce@vermontel.net>, Geoffrey Gardner <Geoffrey323@myfairpoint.net>, Stuart Blood <ssblood@riseup.net>

Ms. Moore,

I believe we both recognize that the rulemaking process begins by "prefiling" the rules with ICAR, so you have not yet actually begun the rulemaking process. It sounds as if you may not begin the process until later this year, or even in 2024.

In the meantime, the Vermont Climate Council, ANR, and Senators like Bray and Baruth move forward with studies, policies, and bills like S. 59 that assume zero-emissions from wood burning and suggest that increasing burning biomass for heat and electricity will reduce our GHGs. This is not acceptable.

While I'm not sure exactly who you consider a "stakeholder," I do know that you do not consider me a stakeholder. Please advise who are the stakeholders and if these meetings will be public. ANR currently sits in the center of a group of organizations that incestuously cite each other's reports and analysis and compound the false assumption that wood-burning is carbon neutral. The recent 2023 Vermont Energy Report published by the DPS makes this relationship explicit. Writing about the Cadmus/Energy Futures Group Pathways Analysis, the DPS report advises that ANR guided EFG to consider wood-burning carbon neutral:

"For example, advanced wood heat is identified as being the most cost-effective measure through 2030, with reductions in vehicle miles traveled (VMT) being the most expensive. It must be noted that, like any modeling, the analysis here is directly related to the inputs. For example, emissions from biomass were, consistent with Agency of Natural Resources guidance,¹¹ assumed to be zero...." (11, 2023 Vermont Energy Report, DPS)

(As you're aware, I have a public records request pending so that I can better understand the nature and extent of the ANR guidance.) The Pathways Analysis is then cited by Energy Action Network reports, the Climate Council then cites EAN reports and the Pathways Analysis, the ANR GHG Inventory cites EAN studies and the Pathways Analysis. EAN then cites ANR reports. The spiral continues ad nauseam. ad nauseam. ad nauseam. From a previous public records request, I have documents that reveal the Ms. Lazorchak sought for the consultants ERG, currently working on the GHG LCA, to also consider wood-burning carbon-neutral in its analysis so I see no end to ANR's misguided influence in direct contravention of 10 VSA 582. I also see no attempts to work with our neighboring states of NY and Massachusetts to create a regional, accurate, and transparent inventory and LCA.

Without knowing exactly who you consider a stakeholder, I believe your stakeholder group is too small as all are working under the scientifically debunked assumption that wood burning is carbon neutral. No stakeholder that I know of has raised concerns about atmospheric warming effects from the black carbon burning wood creates for example. No stakeholder that I'm aware of has broached the concern that while methane gas from dairy farms might be renewable, cows do not absorb methane like trees absorb carbon-dioxide. With this in mind, **I ask to be involved in the stakeholder process and be invited to any stakeholder meetings you plan this summer.**

As you now have plans to begin the rulemaking process for 582 (g) which "shall be the official protocols to be used by any agency or political subdivision of the State," **I ask that you notify the Climate Council, other state agencies, the appropriate House and Senate committee members, and any other state stakeholders which are currently in the process of making decisions based on documents such as the Pathways Analysis, the GHG Inventory, A Climate Budget for Vermont (which focuses on the land use sector but still does not include wood-burning!), etc, that they should postpone any decisions until an accurate and transparent LCA and rulemaking for 582(g) are complete.**

Thank you.

Pike Porter

[Quoted text hidden]



Why District Energy in Burlington?

- Improve McNeil's efficiency 10%
- Use local renewable thermal resource instead of fossil gas
- Reduces over 220,000 MMBTU of natural gas usage *every year* by creating 190,000 MMBTU of renewable steam (including 3 steam sources - waste heat, steam extraction, and supplementary electric boiler), plus 34,000 MMBTU of efficiency savings
- Cut commercial sector natural gas use 16% in Burlington, cut Burlington carbon dioxide emissions approximately 13,000 tons annually, taking single-biggest step to move towards Burlington's Net Zero Energy 2030 Roadmap goal