Vermont's Forested Working Landscape & Modern Wood Heating

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Fairlee, Vermont

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Adam Sherman
BERC at Vermont Energy Investment Corporation

BERC
Biomass Energy
Resource Center

Biomass Energy Resource Center (BERC)

Advancing Community-scale Biomass Energy in North America

Technical Consulting

- Project feasibility studies
- Fuel supply assessments and procurement
- Third-party expert review
- Develop and review of standards
- Market Assessments

Program Design & Implementation

- Expansion potential assessments
- Program management
- Training, and advisory support services

- Showcasing “best practices” and case studies of successful projects
- Tracking market growth and impacts

BERC is a program of the Vermont Energy Investment Corporation
A mission-driven non-for-profit whose mission is to reduce the economic and environmental impacts of energy production and consumption

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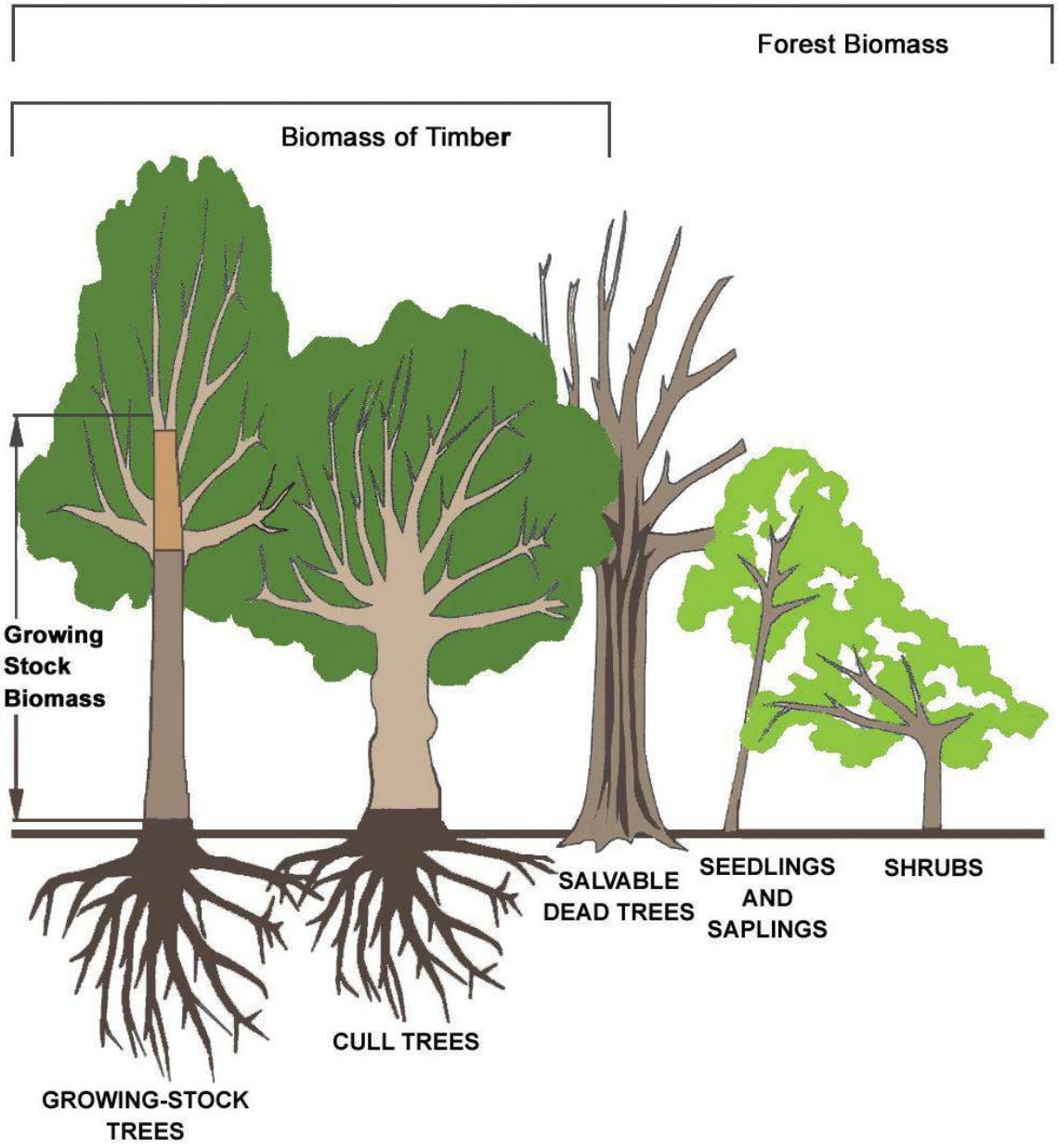
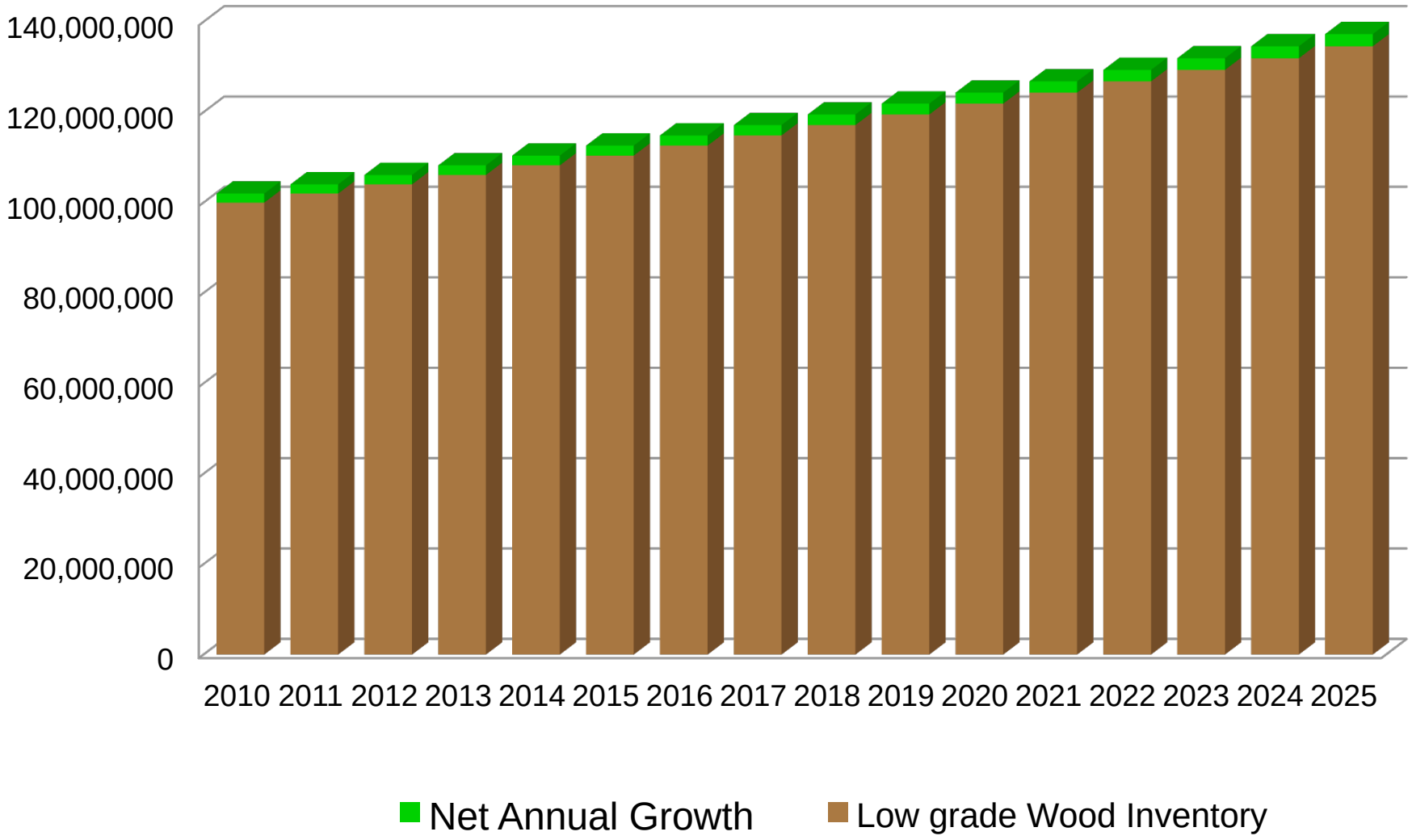
Vermont’s Working Landscape

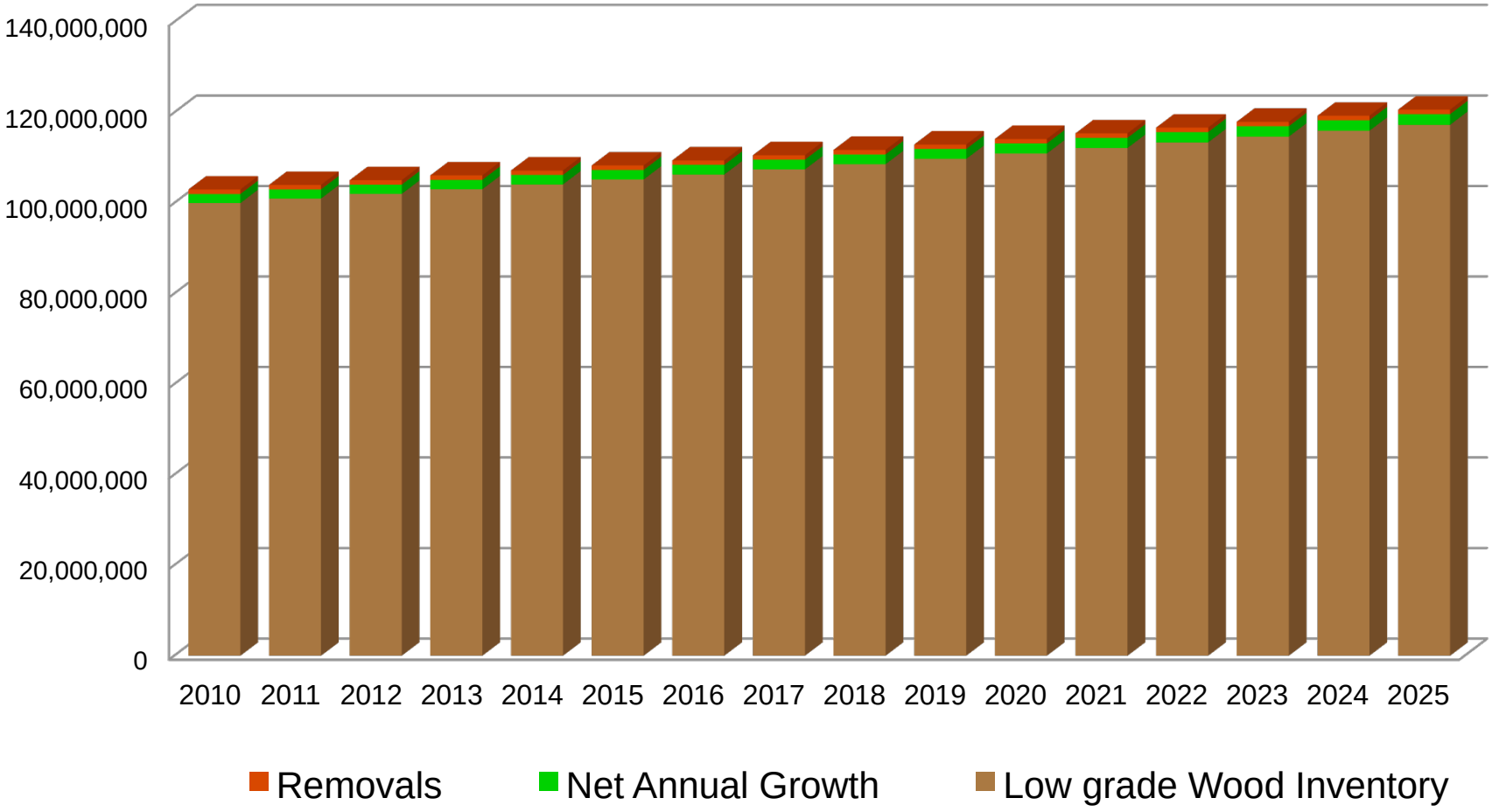
Importance of Managed Forests as part of Working Landscape


Forest Biomass
Biomass of Timber
Growing
Stock
Biomass
SALVABLE
DEAD TREES
SEEDLINGS
AND
SAPLINGS
SHRUBS
CULL TREES
GROWING-STOCK
TREES

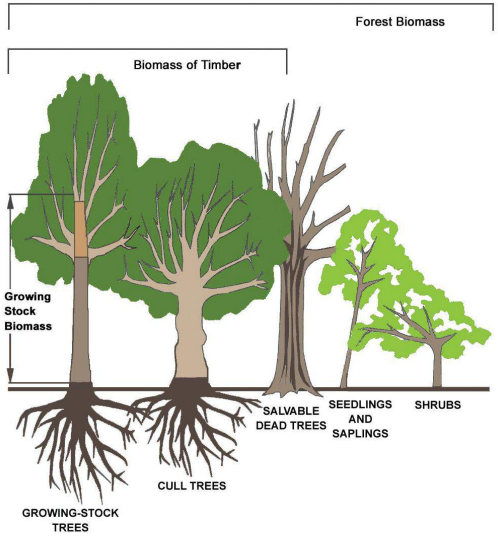
Conceptual Forest Inventory and Net Annual Growth over Time

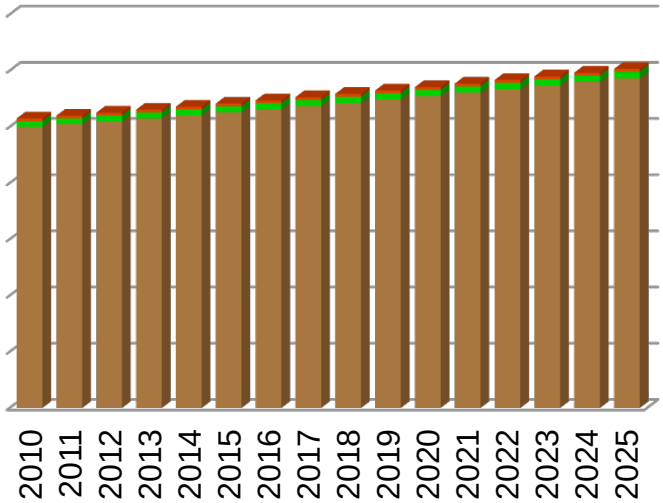


Conceptual Forest Inventory, Growth, and Removals over Time



Vermont Forest Resource Capacity





Traditional Wood Heating Fuels

Chunkwood

PROS: Simple, cost effective, easy to self-supply

CONS: Manual feed, less efficient combustion, less convenient

Woodchips

PROS: Cost effective fuel, by-product supply, great for heating large facilities

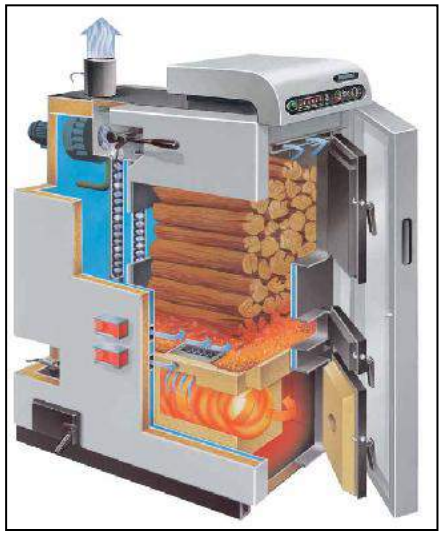
CONS: High capital costs, not effective for residential heating

Wood Pellets

PROS: Energy dense fuel, clean burning, efficient, and convenient

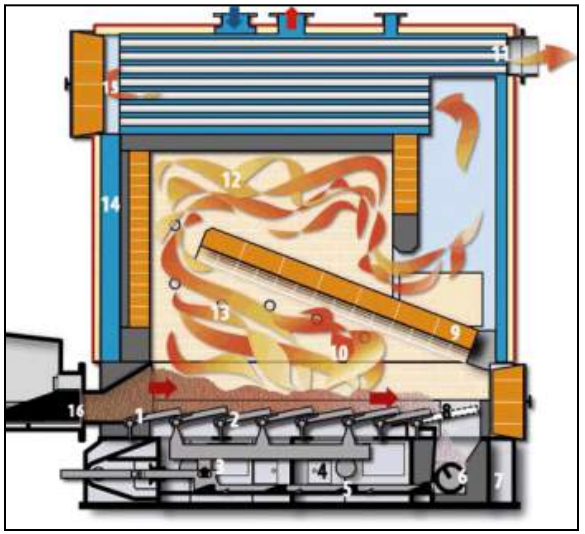
CONS: Higher cost per MMBtu

Modern Wood Boiler Technology



Cordwood system

Pellet system



Woodchip system

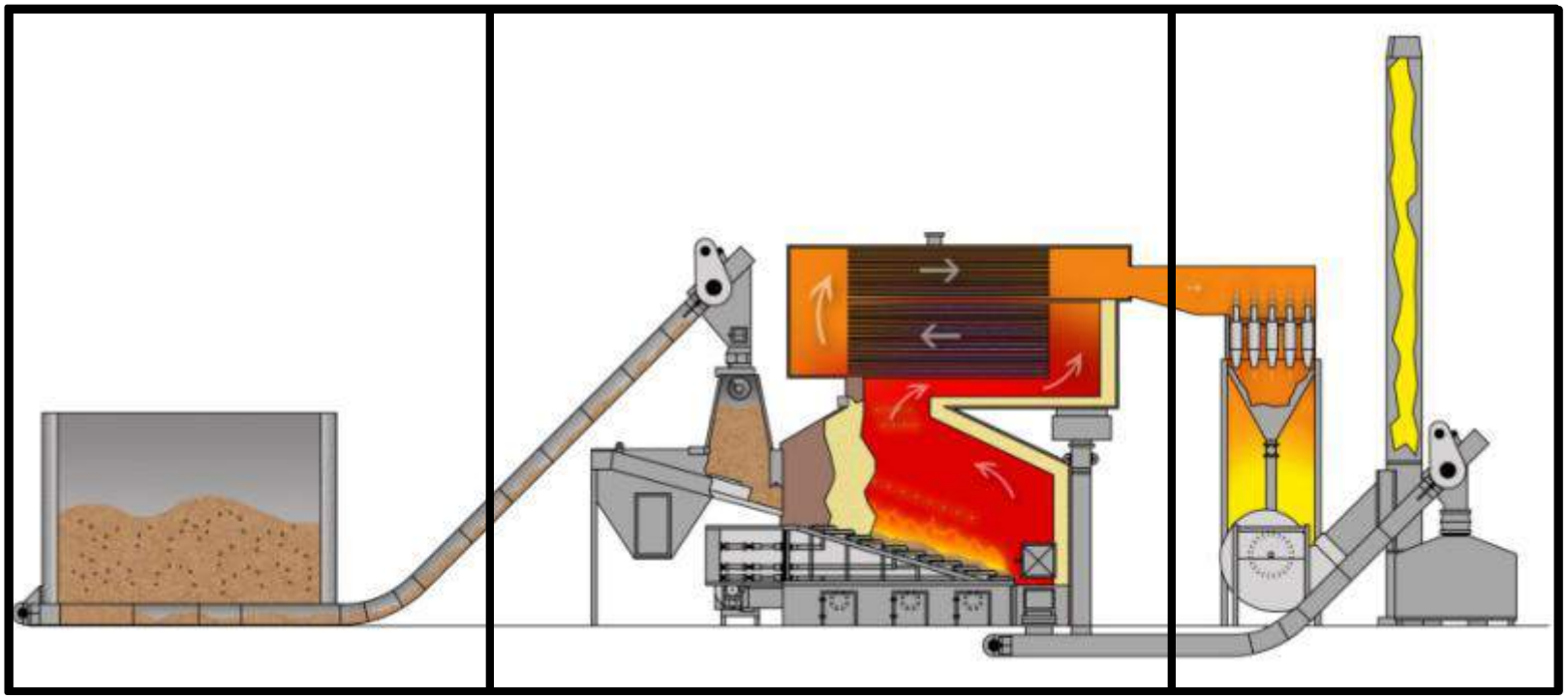
Technology	Cordwood Boilers	Pellet Boilers	Single Facility Woodchip Heating	District Heating w/ Woodchip Boilers	Industrial CHP
					
Typical heat output capacity	20kW – 100kW	20kW - 1MW	500kW – 9MW	1.5MW – 15MW	8MW - 150MW
Applications	Home heating and farm buildings	Home heating & small commercial buildings	Schools, hospitals, office buildings, etc.	College campuses and downtown communities	Merchant Power Plants
Fuel Type					
Annual Fuel Use	2-15 cords	2-20 tons	100 – 10,000 tons	500- 50,000 tons	1,000 – 500,000 tons
Fuel Sourcing	Locally harvested firewood	Premium pellets	Paper grade and screened bole chips	Bole chips and whole-tree chips	Whole-tree chips and hog fuel
Average Efficiency	70%	80%	75%	75%	28% - 40%

Automated Wood Heating System Configuration

Fuel Storage

Combustion Equipment

Emissions Control Equipment & Stack



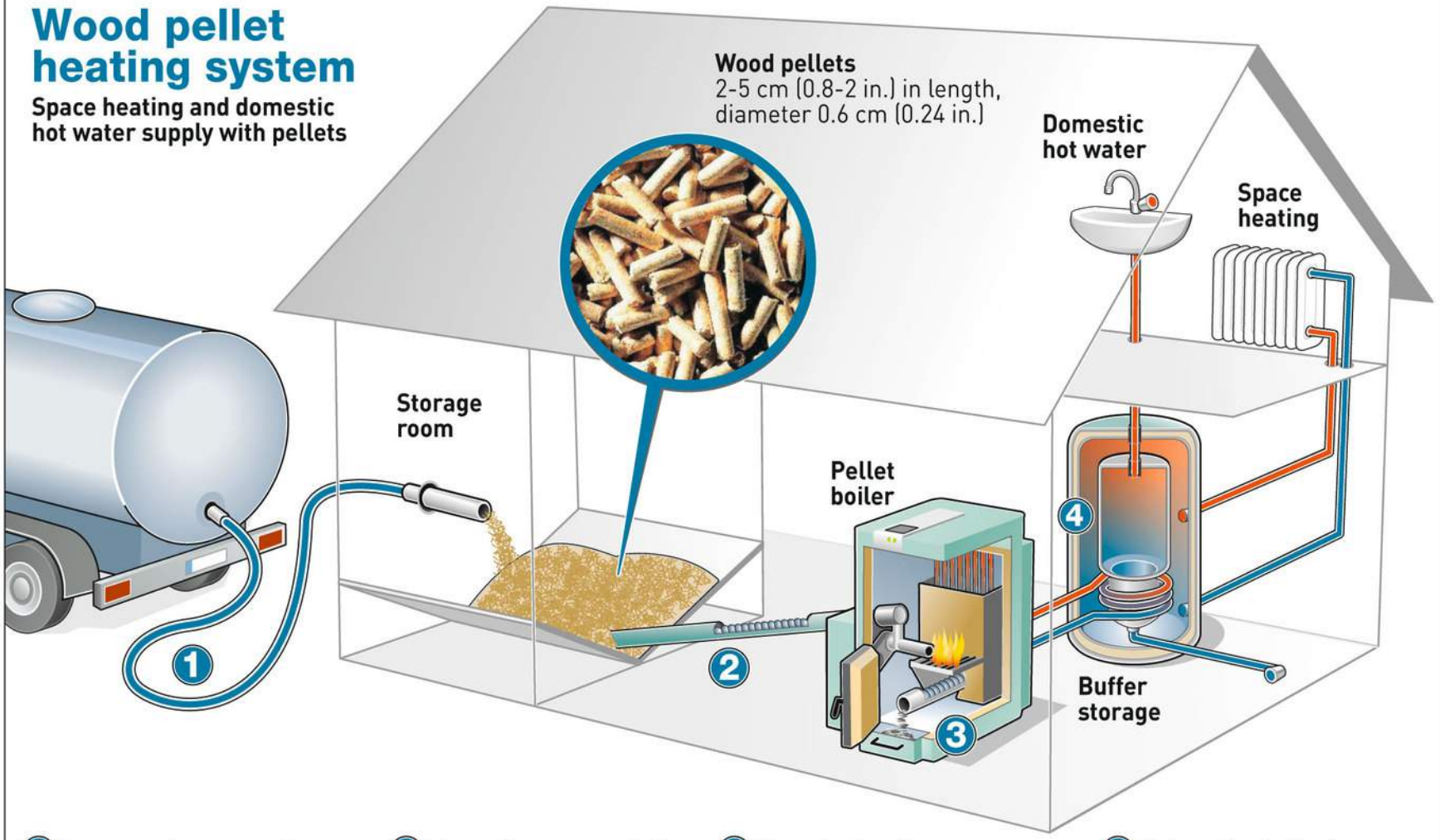
Pellet Silos
Slab chip bins
Below grade chip bins

Stoker/fixed grate
Stoker/moving grate
Pneumatic/suspension
Fluidized bed

Single cyclone
Multi-cyclone
Baghouse
ESP

Wood pellet heating system

Space heating and domestic hot water supply with pellets



1. Once or twice a year the pellets are delivered by a silo tanker. A loaded storage room of 4.5 m² is enough to keep a single-family house warm for one year.

2. The pellets are carried from the storage room to the boiler by a fully automatic pellet feed.

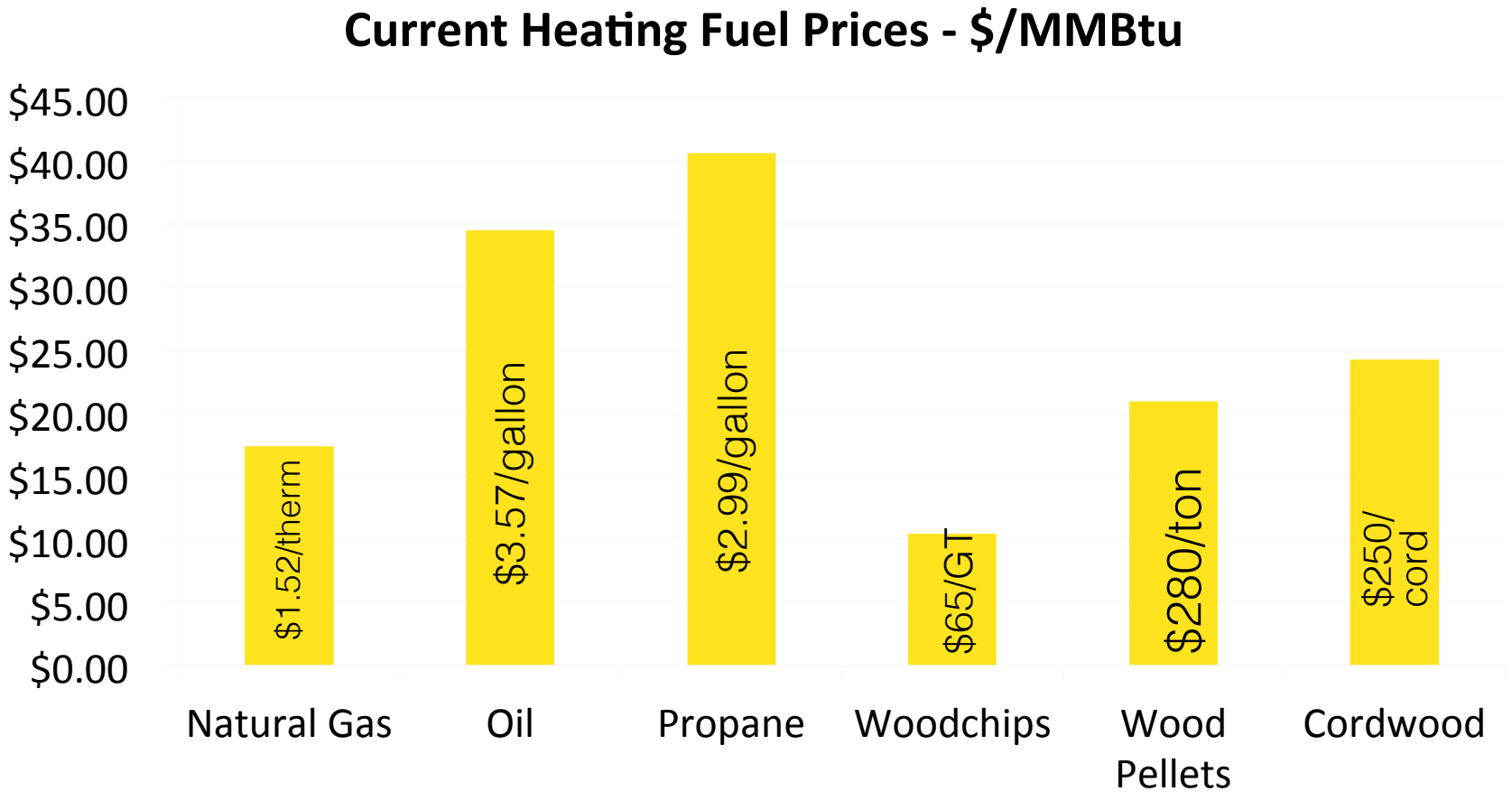
3. After the burning process all that's left is ash – with a weight of only 0.5 per cent of the original pellet. The ash can be disposed of with the domestic waste.

4. If the pellet boiler is interconnected with a buffer storage, emissions can be reduced and efficiency increased.

www.unendlich-viel-energie.de

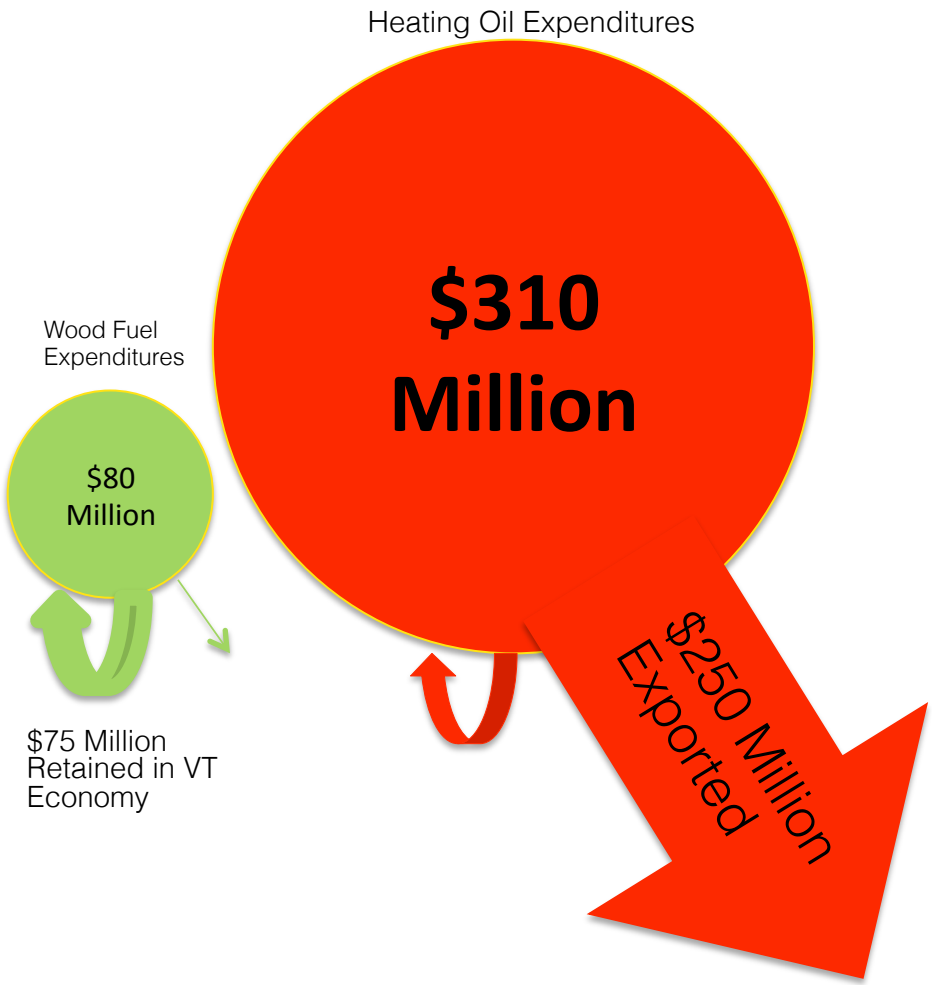
Renewable Energies Agency

Cost of Heating Fuels in Vermont

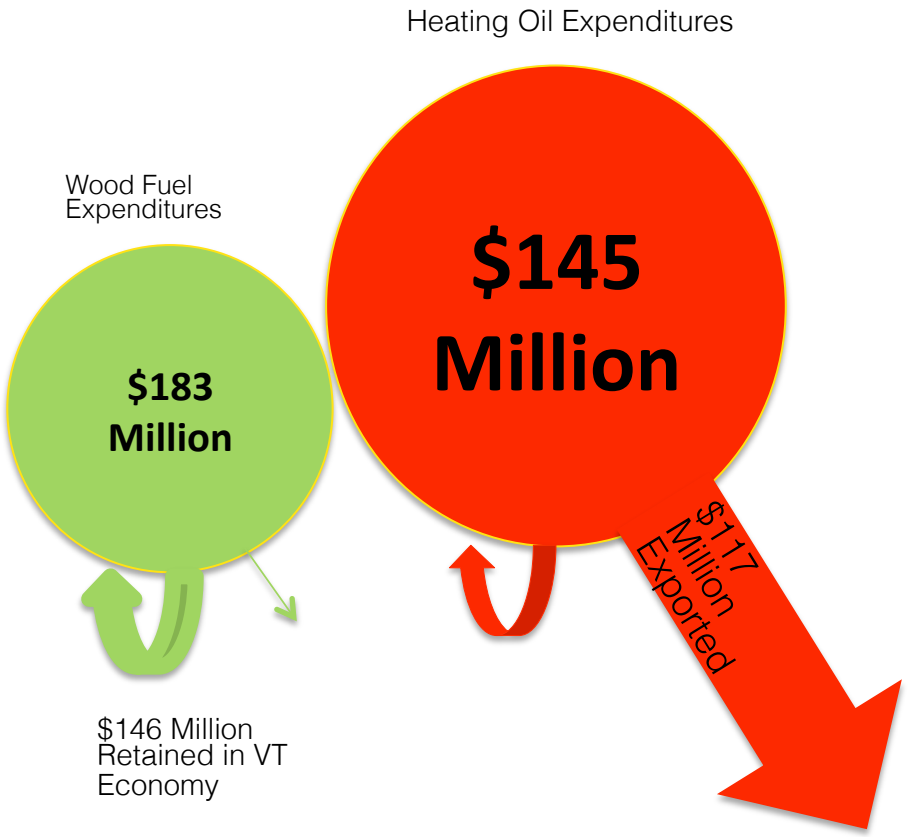


Data sources: VT Fuel Report and BERC

Today



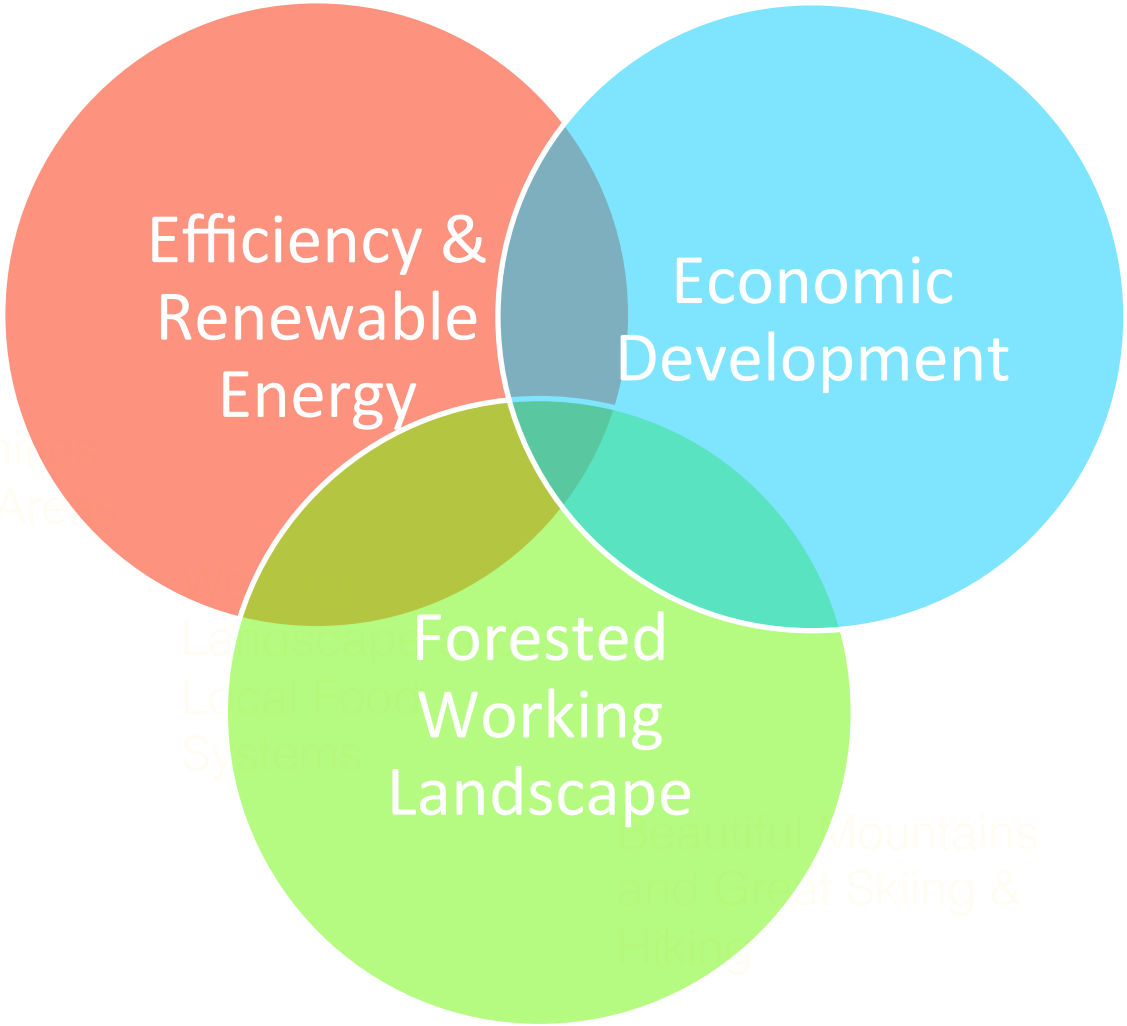
2030?



- $70 Million increase in local fuel investment
- and $131 million avoided export on oil

Source: Estimates prepared by BERC using EIA and VTDPS data

Part of the Solution: Modern Wood Heating



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Check out new video on Modern Wood Heating
- http://www.youtube.com/watch?v=Ww9zppMoIiY

www.biomasscenter.org

Vermont Dependence on Oil for Heating

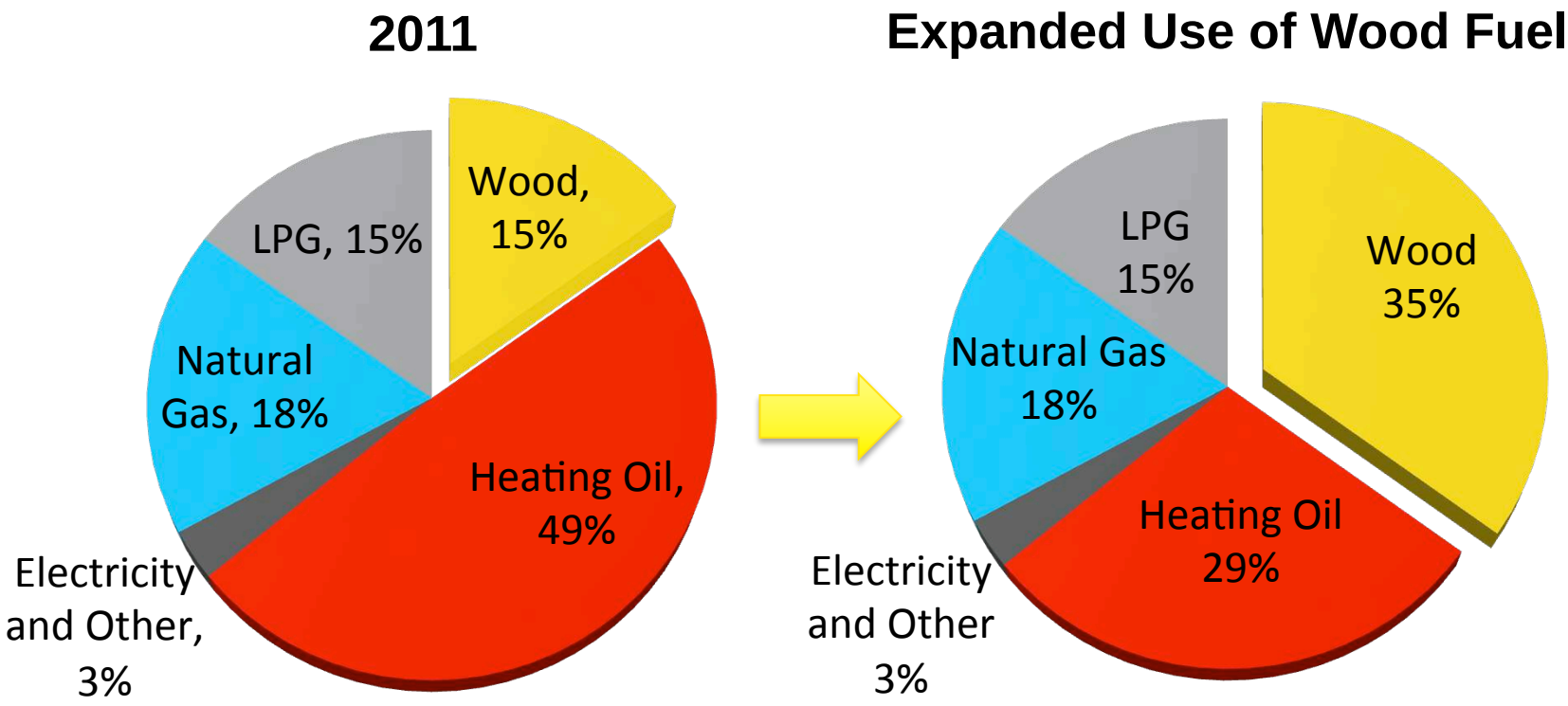
	Annual Gallons of Heating Oil[1]	Population[2]	Gallons Oil/ Capita
Connecticut	473,000,000	3,500,000	135
Maine	263,000,000	1,300,000	202
Massachusetts	596,000,000	6,646,000	90
New Hampshire	137,000,000	1,320,000	104
New York	1,308,000,000	19,570,000	67
Pennsylvania	757,000,000	12,763,000	59
Rhode Island	131,000,000	1,050,000	125
Vermont	89,000,000	626,000	142
Total/Average	3,753,000,000	46,775,000	80

Source: Energy Information Administration (EIA

Woodchip District Heating - Montpelier

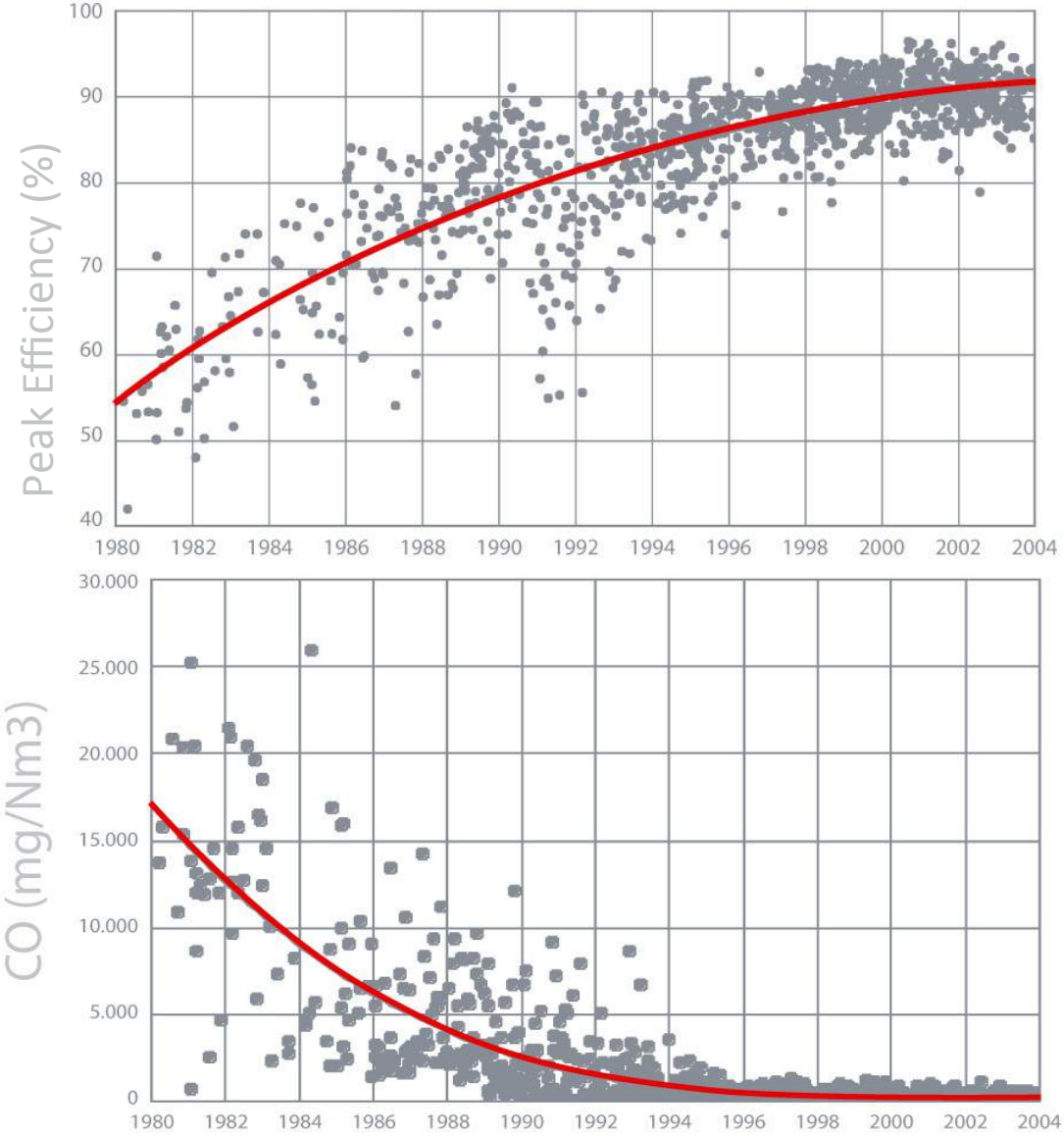
DISTRICT HEAT MONTPELIER
AN ENERGY INDEPENDENT DOWNTOWN

Our Goal:
Dramatically Expand Modern Wood Heat in Vermont



Source: EIA consumption data and BERC analysis

Advancements in Modern Boiler Systems



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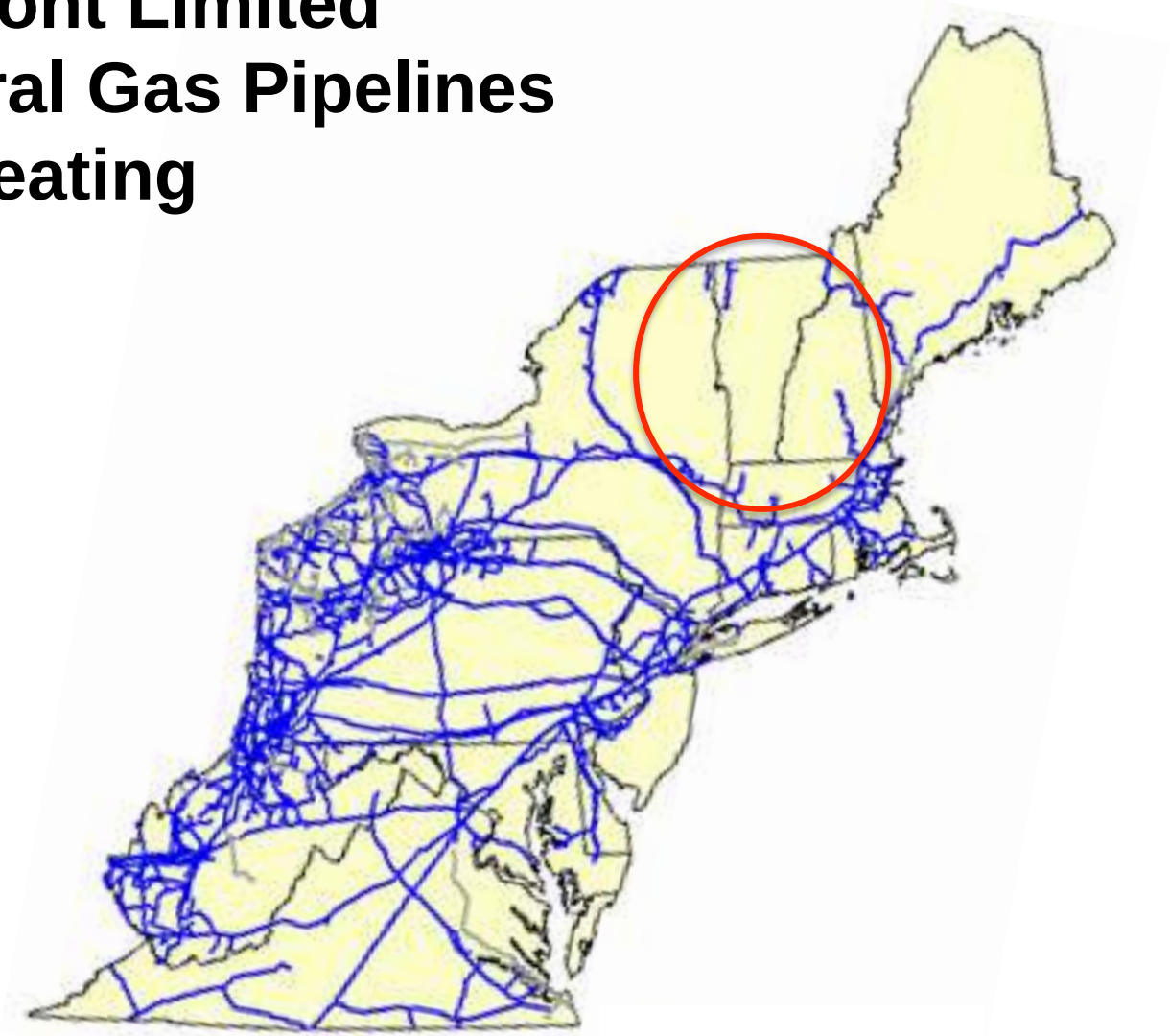
Source: Dr. Christian Rakos, ProPellet, Austria

Vermont Limited Natural Gas Pipelines for Heating



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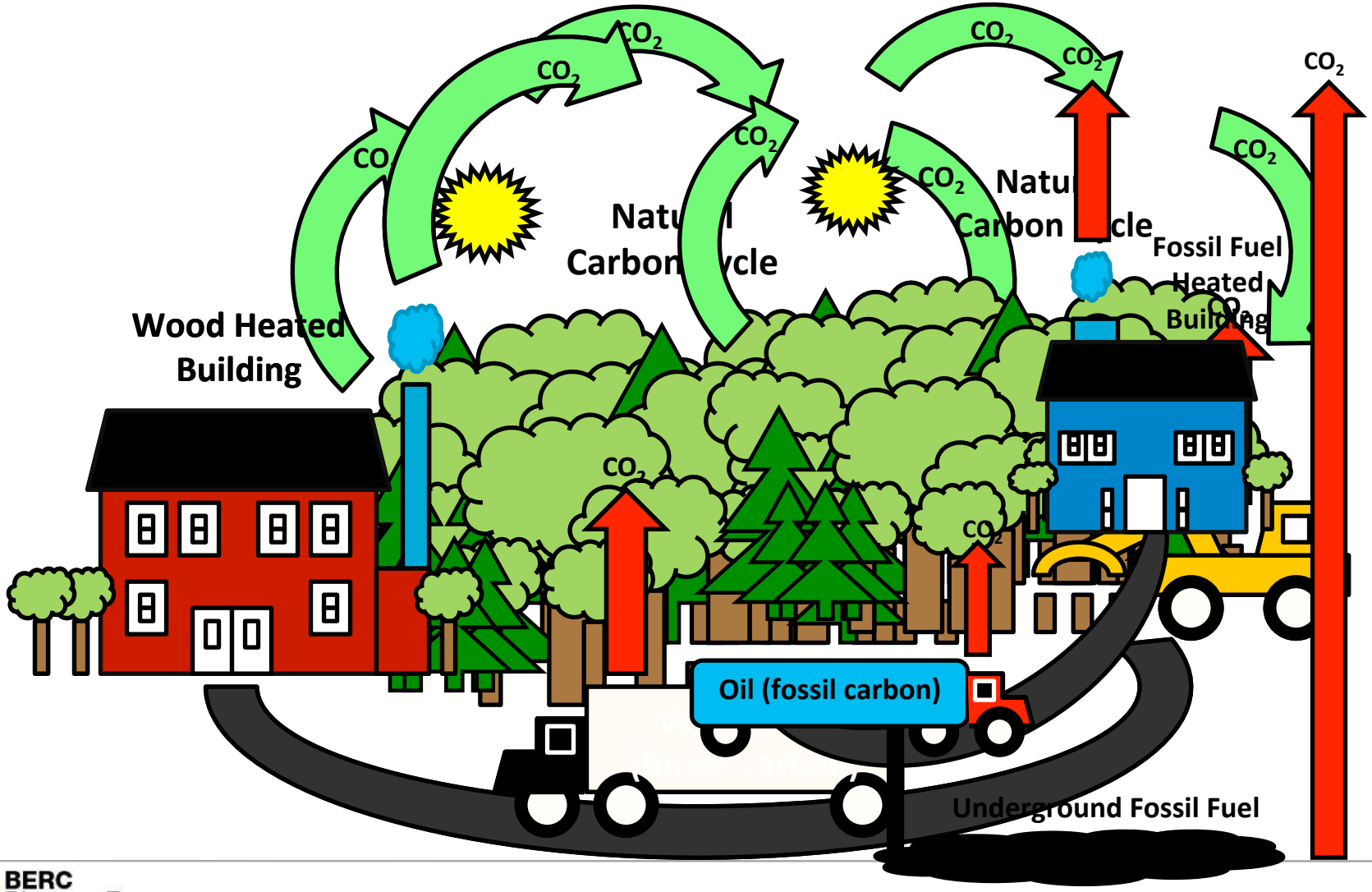
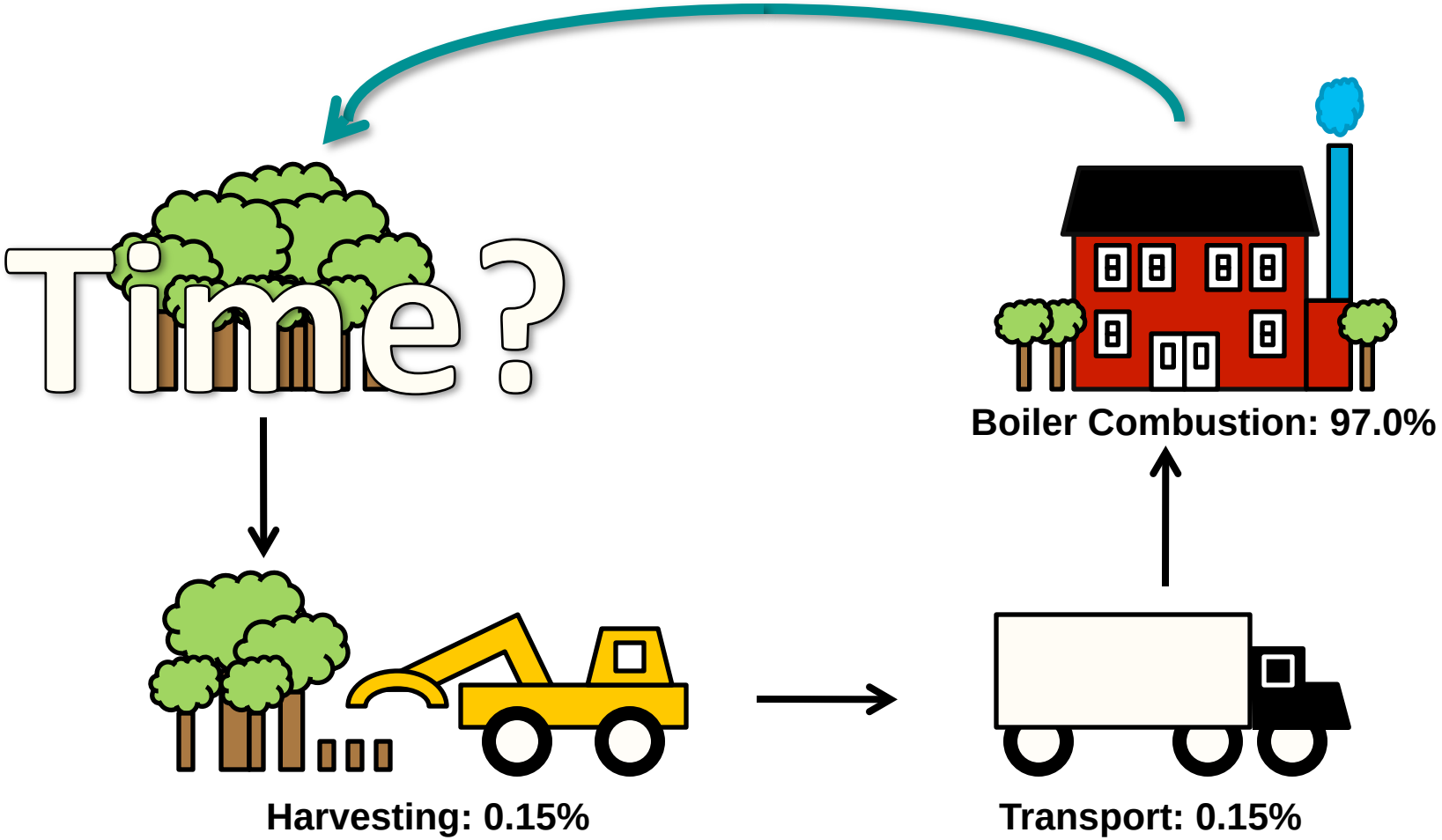
The Carbon Cycle

Biomass Heated Buildings vs. Fossil Fuel Heated Buildings



Life-Cycle Carbon Impacts of Wood Energy



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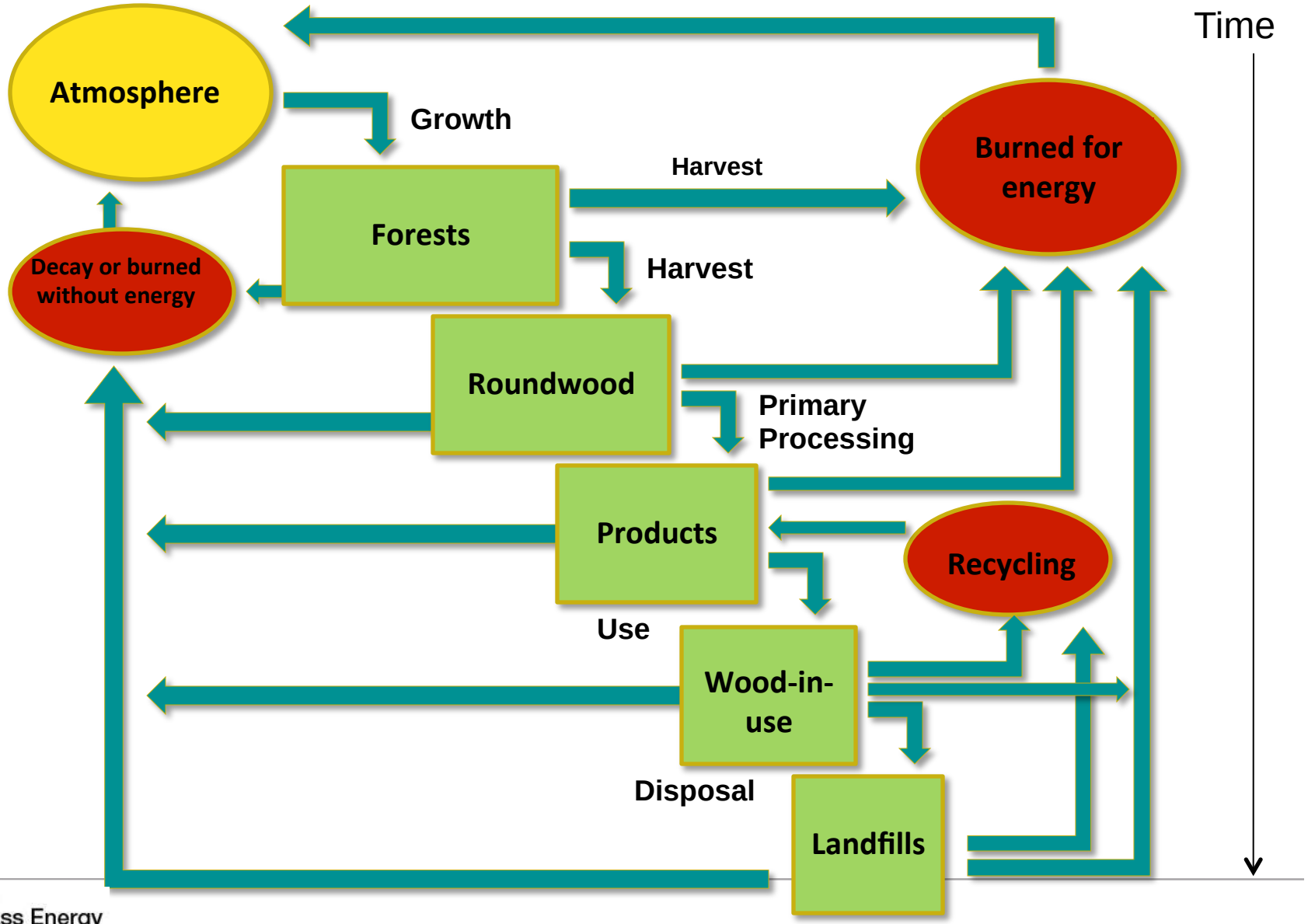
Data Source: RSG, Inc.

Carbon Life-Cycle of Wood Products



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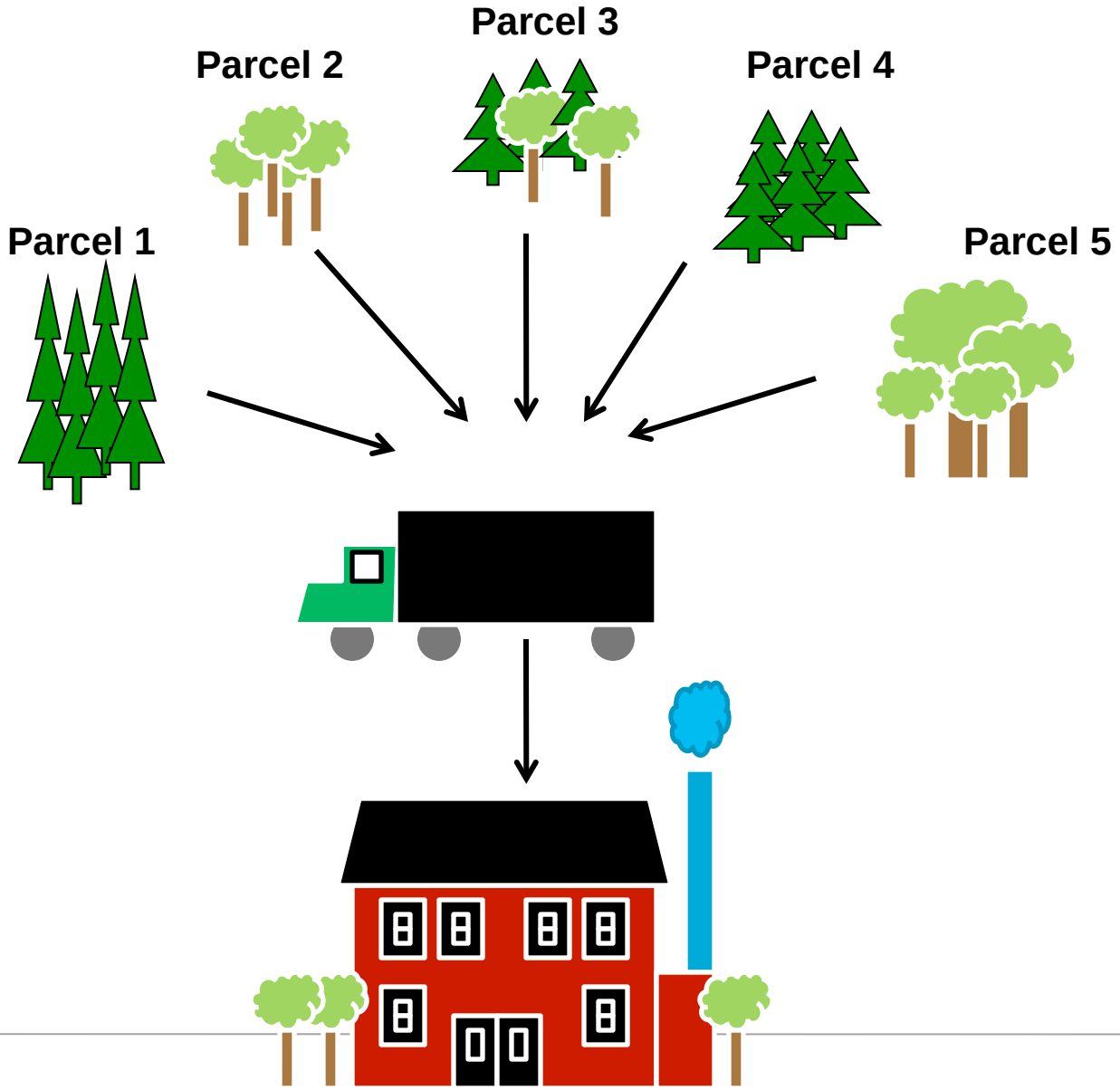
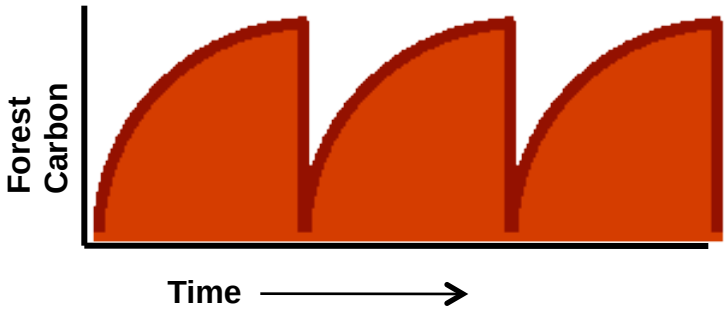
Skog and Nicholson, 2000

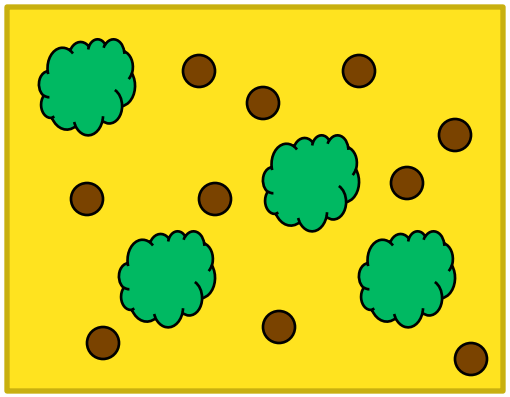
Forest Management and Harvesting Vary Widely based Current Conditions and Management Objectives



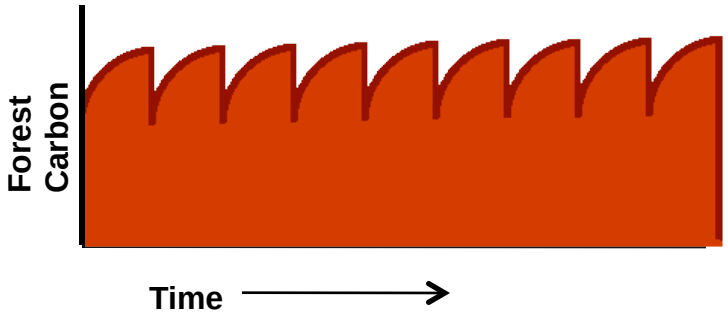
Spatial Factors of Measuring Carbon Impacts

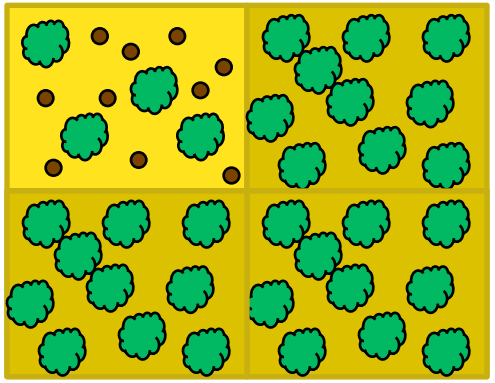
Stand Level





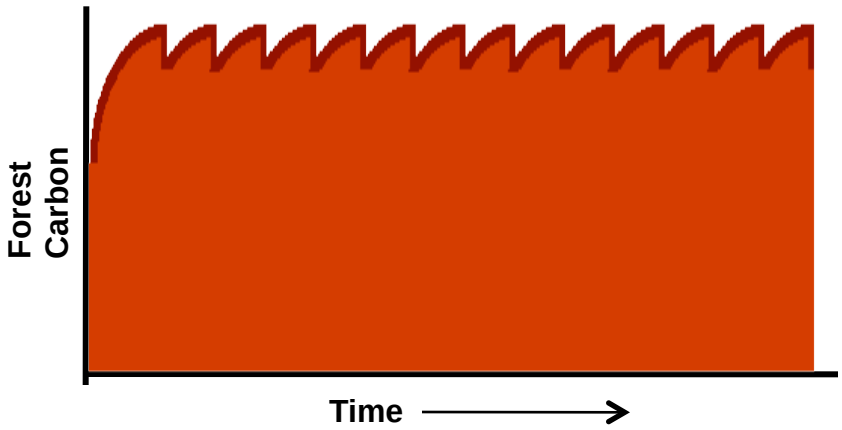
Large Parcel Level

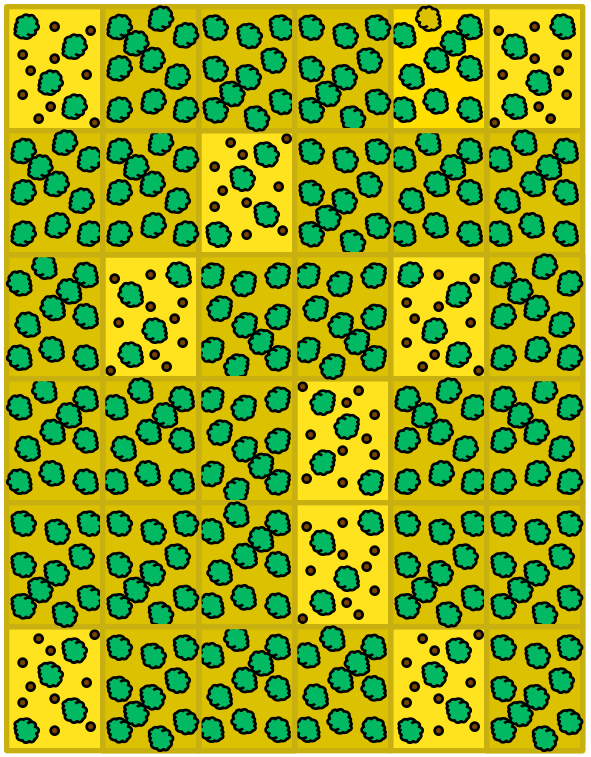




Spatial Scale of Analysis (continued)

Landscape Level





Cumulative Debts and Dividends Over Time – Thermal Applications