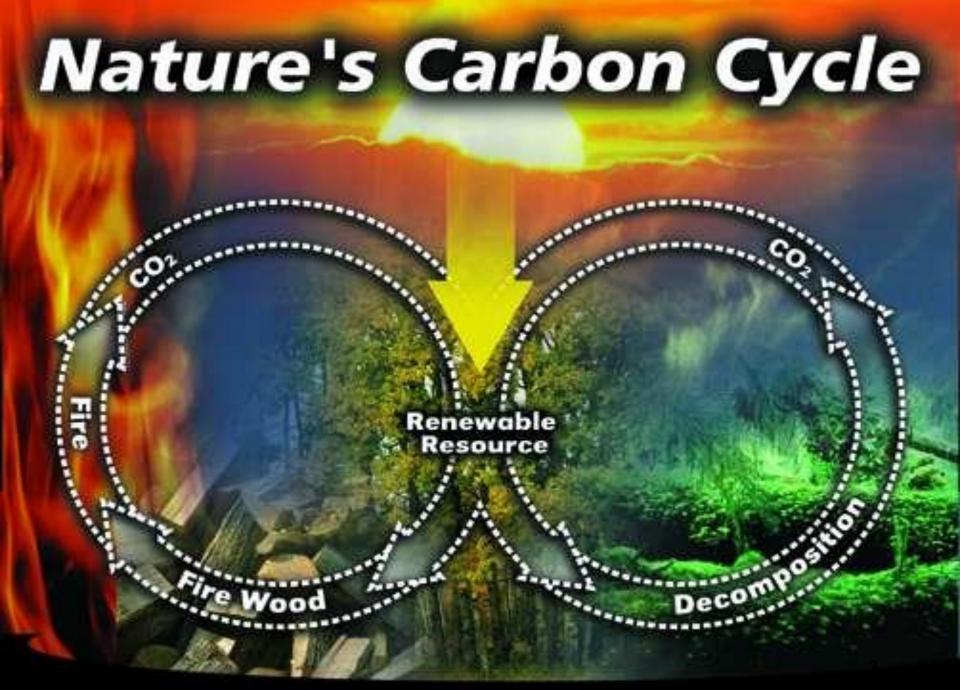


Topics we can cover this morning

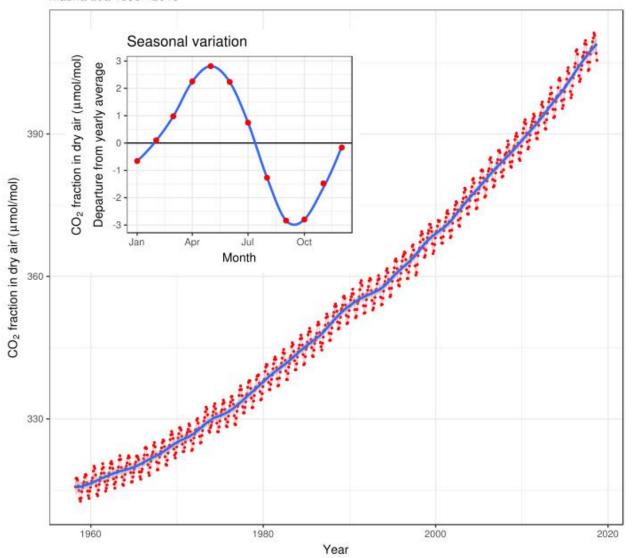
- 1. The carbon cycle & GHG emissions
- 2. Overview of technologies
- 3. Big changes to emissions rules
- 4. Good firewood: the key to high efficiency
- 5. The importance of burning without smoke



The 'Keeling Curve'

Monthly mean CO2 concentration

Mauna Loa 1958 - 2018



Heating with wood saves tonnes

- Displacing one 200 gallon tank of fuel oil by heating with wood cuts carbon emissions by about two tonnes.
- In an average house, annual CO²
 emissions can be cut by at least four
 tonnes!

The Appliance: Stove Fireplace or Central Heater

Conventional Wood Stoves



Advanced Wood Stoves



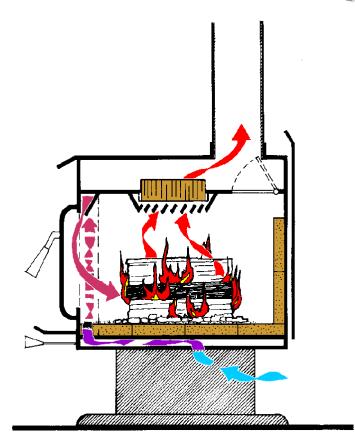
Advanced Woodburning Technology

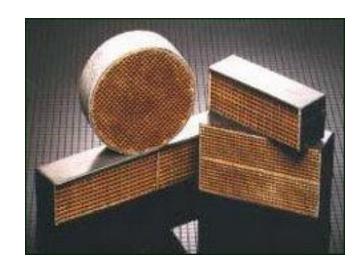
- Advanced technologies offer several advantages, including:
 - Much higher efficiency
 - Much less smoke pollution
 - Greater safety because less creosote is formed
 - Burn less wood for more heat

Two types of advanced combustion:

- 1. Catalytic
 - uses catalyst to clean up exhaust
- 2. Non-catalytic advanced
 - most common type in Canada

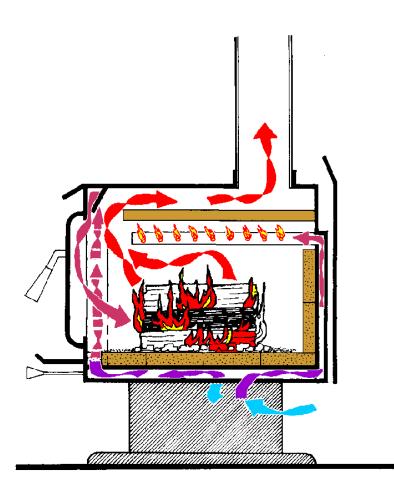
Inside a catalytic wood stove





Smoke passes through a catalytic honeycomb that lowers smoke ignition temperature

Inside a 'non-cat' wood stove

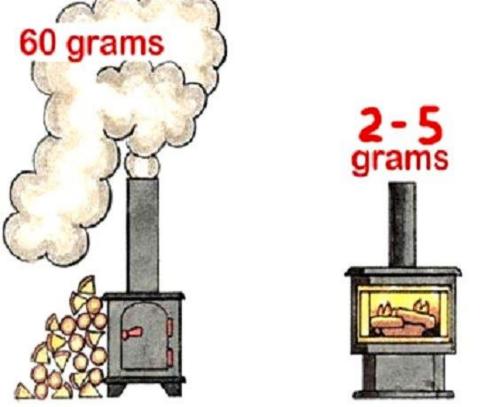




1. Firebox insulation 2. A large baffle 3. Preheated combustion air

Compare old with new:

Particulate emissions in one hour:



Overall Efficiency

40 – 50%

60 - 80%

New EPA Emissions Rules

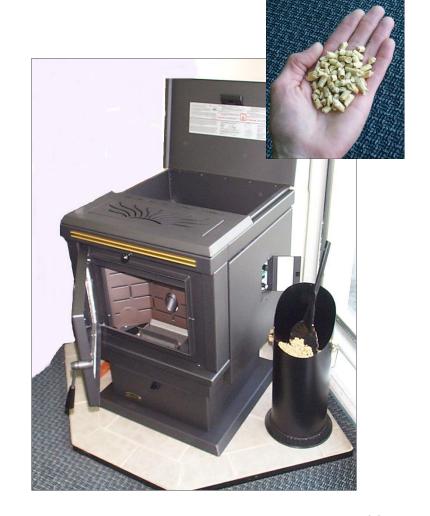
- A minor change took effect in 2015
 - Limits imposed in 1990 of 7.5 g/h for noncatalytic stoves and 4.5 g/h for cat stoves were reduced to 4.5 g/h for both
- A major change happens 5 years later (2020), limits for both reduced to 2 g/h
 - Limits for cats and non-cats reduced to 2 g/h





Pellet stoves

- Pellets are made from sawdust that is ground, dried and compressed
- These stoves can operate up to 24 hours unattended
- Their big advantage over wood heaters is convenience



Comparing Pellets to Firewood

- Pellets have an EROI of about 17:1
- Pellet appliances need professional maintenance
- Users are dependent on fuel suppliers
- Long term pricing is uncertain

- Firewood has an EROI of about 30:1
- Wood heaters can be maintained by the user
- Users can be as independent as they wish
- Fuel pricing is relatively stable

Conventional Fireplaces

- Conventional masonry and conventional factory-built fireplaces are not efficient and are not suitable for home heating
- They are also a source of air pollution





Fireplace Inserts

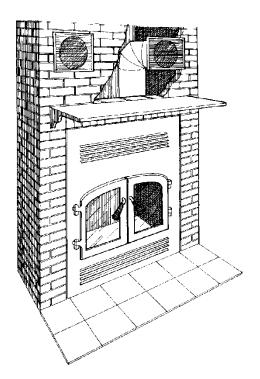
 A fireplace insert can transform a conventional fireplace into an efficient heating system.



High efficiency fireplaces

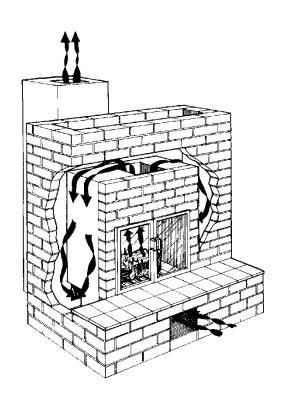
 Advanced technology fireplaces have the same combustion features as advanced wood stoves





Masonry heaters

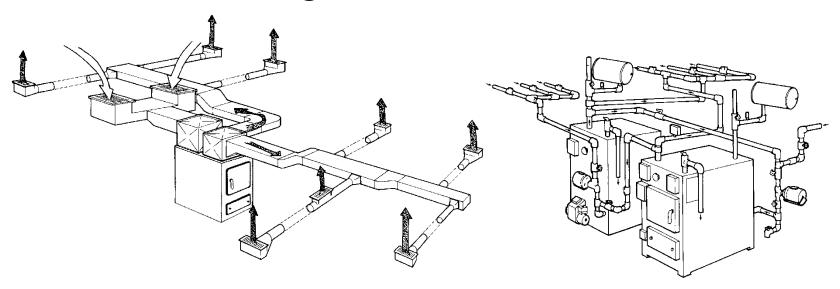
 A masonry heater is a low smoke, high efficiency heating option



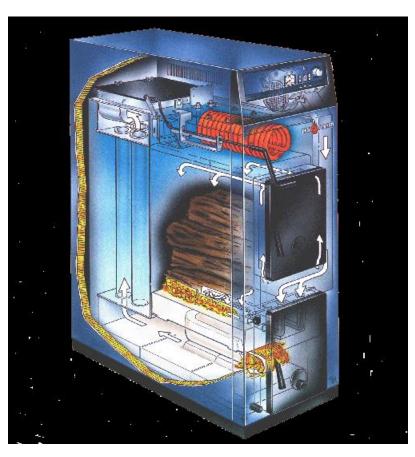


Central Heating

 Most wood furnaces and boilers are not clean burning and efficient



Clean burning furnaces and boilers



BioHeat (Tarm)

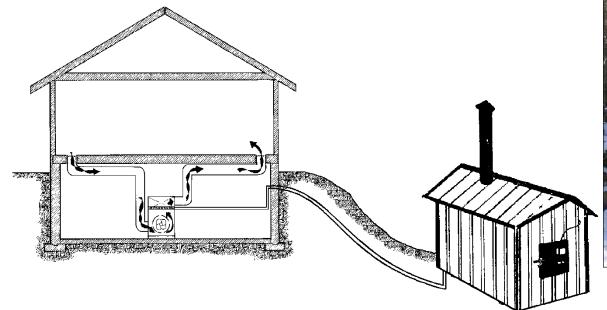


PSG Caddy

Outdoor boilers

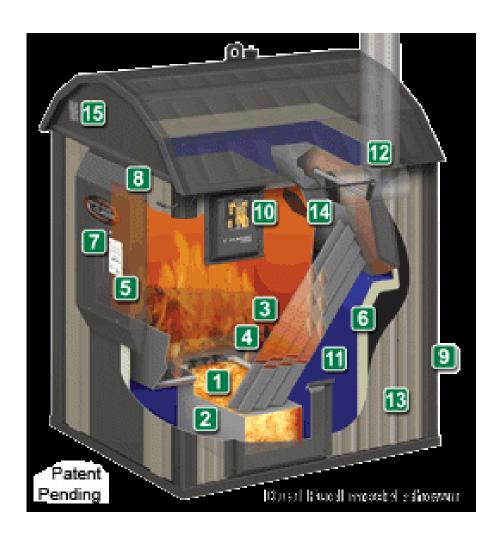
Their large, simple fireboxes make

clean burning difficult.





Low emission outdoor boiler



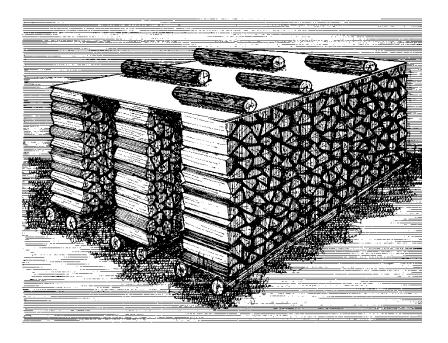


A definition of sustainable woodlot management:

 Uneven-aged, selective harvesting, thinning of dense stands and removal of poorer quality trees, while leaving seed trees of all present species and ages, and some standing dead trees to provide wildlife habitat.

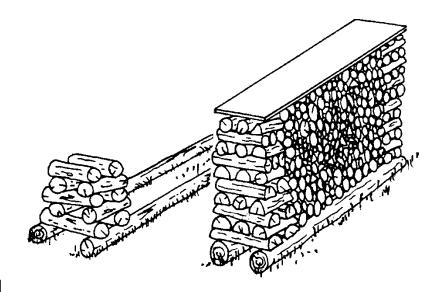
A cord of firewood

- A full cord measures 4 feet by 4 feet by 8 feet or 128 cu. ft.
- At right are three "face" cords each measuring 4' high by 8' long by 16" wide, or 43 cu. ft. each or combined, one full cord.



A year in advance, or at the latest, in early spring, the wood should be:

- 1. Cut to length
- 2. Split to a variety of sizes, and
- 3. Stacked on rails to keep it off the ground
- 4. Just the top covered



To be ready for burning in the fall

How to tell if wood is dry

- 1. There are cracks in the end grain
- 2. The wood darkens with aging
- Dry wood sounds hollow when struck, wet wood sounds dull
- 4. Split a piece: if the fresh surface feels damp, it is too wet
- 5. Burn some: if it hisses, it is much too wet



How long does it take to season firewood?

- Light woods like poplar, pine, spruce and willow take at least one full summer to season.
- Harder woods like maple, oak, ironwood, beech and elm take at least a year to season.
- (assuming the wood is stacked in covered windrows in an open area exposed to sun)

What is the best wood to burn?

- All species have about the same heat energy per pound; the difference is in density
- High value hardwoods like maple and oak may be too rare in your woodlot to burn
- Lower value, shorter lived species like poplar and birch make excellent firewood, especially in spring and fall
- In Canada's north people burn spruce, white birch and aspen and manage to stay warm

Moisture, mould & bugs

- Don't bring wet wood into the house because it can lead to serious moisture problems and promote mould growth
- Avoid rotted and mouldy firewood because it can cause allergic reactions
- Stressed, diseased trees attract bugs and are often used for firewood; check for bugs and always store firewood off the ground

Do Burn

- Clean, seasoned firewood
- Just enough plain newspaper to get the fire started
- Commercial woodbased fire starters can also be used

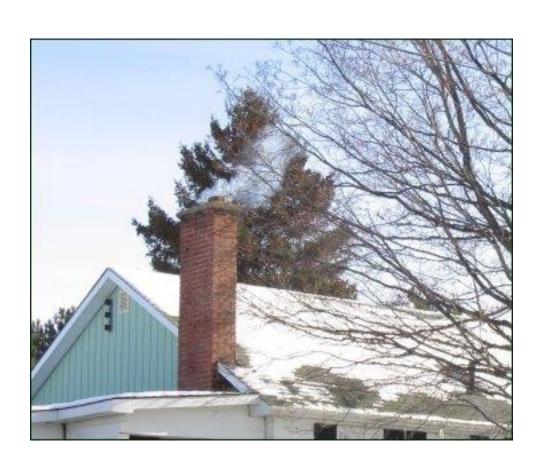
Don't Burn

- Coated, painted or pressure treated wood
- Salt water driftwood
- Plywood, particle board or any wood with glue on or in it
- Household garbage
- Cardboard and paper products
- Unseasoned wood

There is a Firewood Video on woodheat.org

- "Forest to Wood Shed"
- Covers species, processing, stacking and seasoning strategy

Is there smoke coming from your chimney?



Signs of poor wood burning practice



How to burn without making smoke

- 1. Burn hot, bright fires
- 2. Before loading, rake your coals
- 3. Burn in cycles
- 4. Use smaller loads in mild weather
- 5. Let the space cool a little before loading
- 6. Fire each load hot before turning down

Judge your progress, check your chimney!

- You can judge your progress towards clean burning by looking up at your chimney
- A little smoke is normal just after loading
- But a fire that is burning properly produces little or no visible smoke from the chimney
- Check the chimney and judge your progress!

Visit us at woodheat.org

