

Crop Biomass an Overview

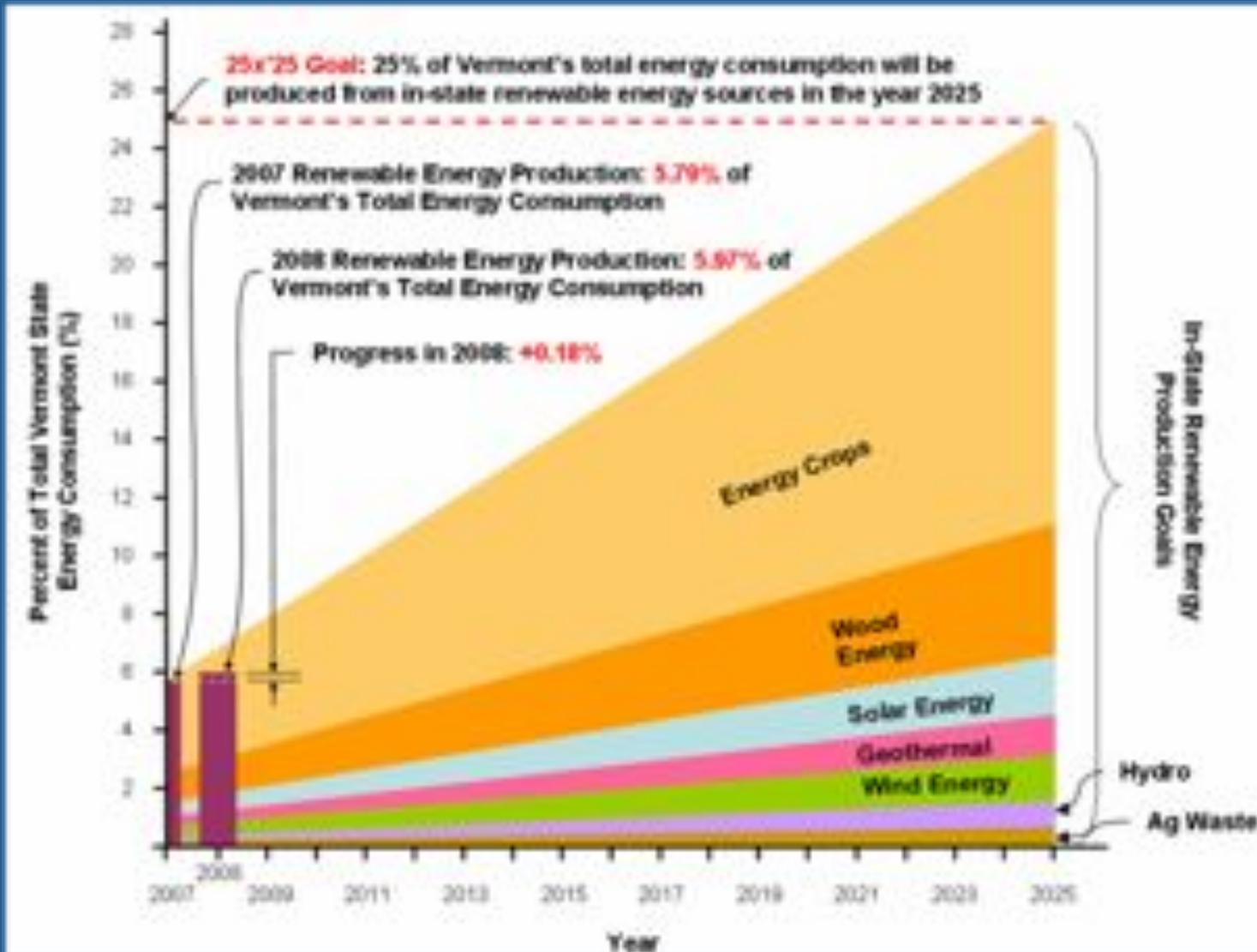
Issues, Markets, Combustion & Money

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Good news & Bad news

RENEWABLE
ENERGY
RESOURCES



Enabling Technologies

RENEWABLE
ENERGY
RESOURCES

- Plant science
 - More \$\$/acre
 - Increased yield
 - Faster germination
 - Crop selection
 - Crop mix
- Compaction
 - Cost of transportation
 - Ease of handling
 - Pellets
 - Briquettes
 - Chopped
 - Fixed or mobile facility
 - » 5,000-8000 ton/yr

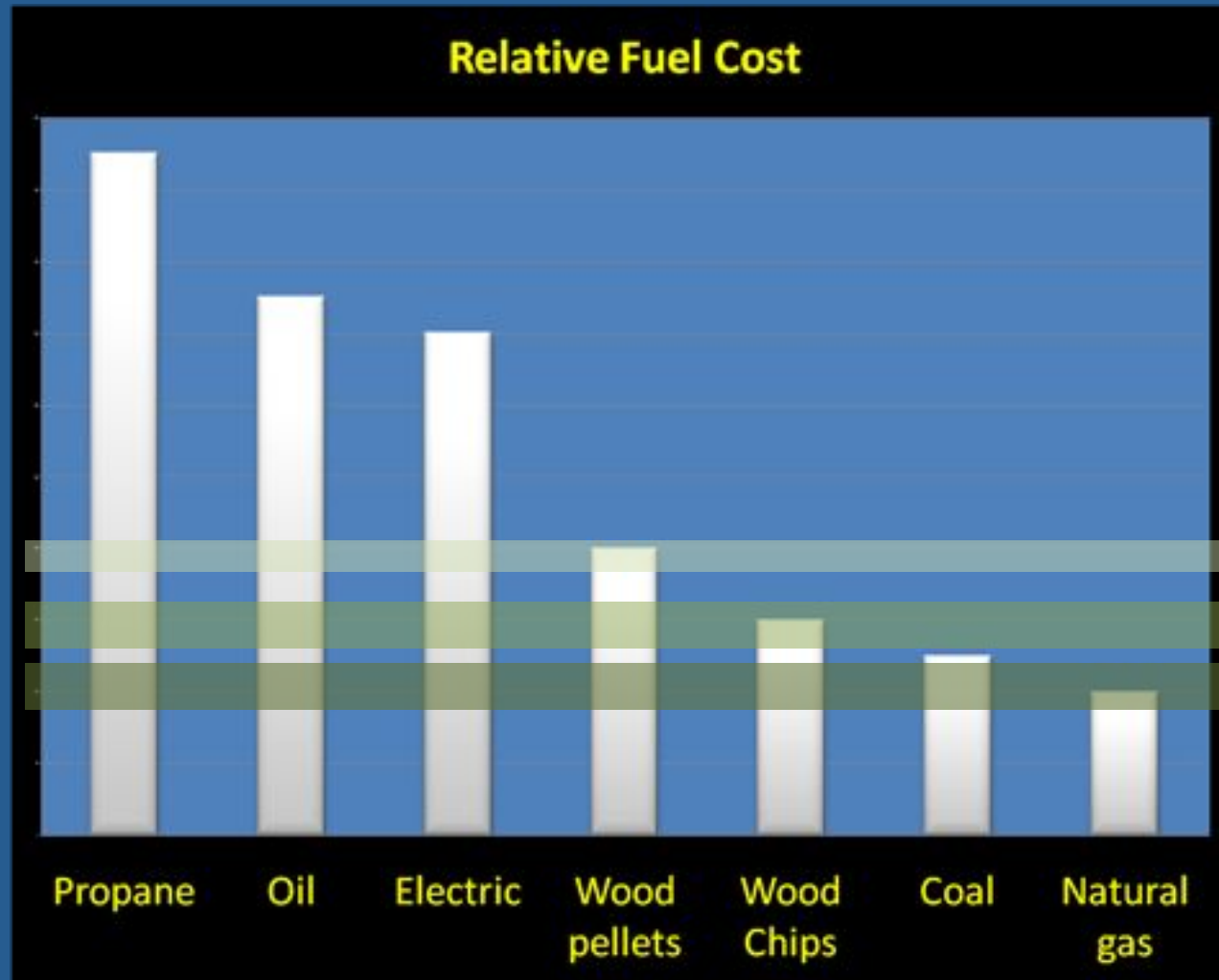


Miscanthus trial on an INRA test field. Credit: INRA/S. Calvo



Customers

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RESOURCES



Pellets

Briquettes

Chopped

Customer motivation-----Cost may not be the most important issue

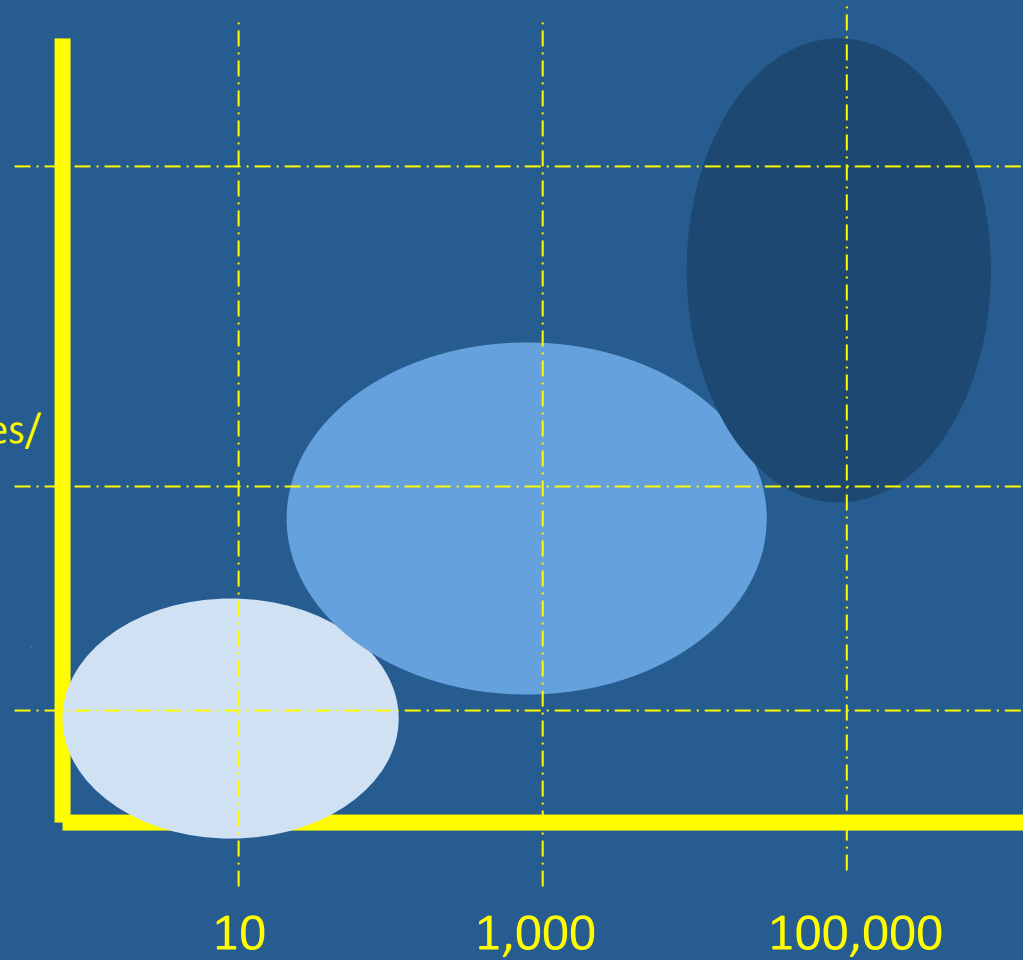
Markets

RENEWABLE
ENERGY
RESOURCES

HUGE
Power Plants/Process
Industries

Medium
Industrial/Schools/Colleges/
Hospitals, Etc

Small
Domestic/Small
industrial



Small

RENEWABLE
ENERGY
RESOURCES

- Domestic
- Small industrial
- Pellets
- Easy to handle
- Boiler to handle
 - Higher ash
 - Higher mineral
 - Not all boilers will work



Medium

RENEWABLE
ENERGY
RESOURCES

- Customers
 - Industrial
 - Schools
 - Colleges
 - Hospitals
 - Prisons
- Fuel
 - Grass-Bales/chopped
 - Grass Briquettes
 - Wood Chips
- Boiler features
 - Multi-fuel
 - Automatic controls
 - Automatic ash removal



Huge

- Customers
 - Power plants
 - Process industries
- Fuel
 - Lowest cost
 - Government policy
 - Chopped grass
- Boiler concerns
 - Corrosion
 - Minerals



Combustion

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Concern	Effect	Solution
Thermal energy content	All biomass about the same	Moisture Content
High Mineral Content	High ash Corrosion	Correct harvesting Less than Bark Less Cl than wood
Emissions	Particulate matter	Boiler design Compaction Stack control

Money

RENEWABLE
ENERGY
RESOURCES

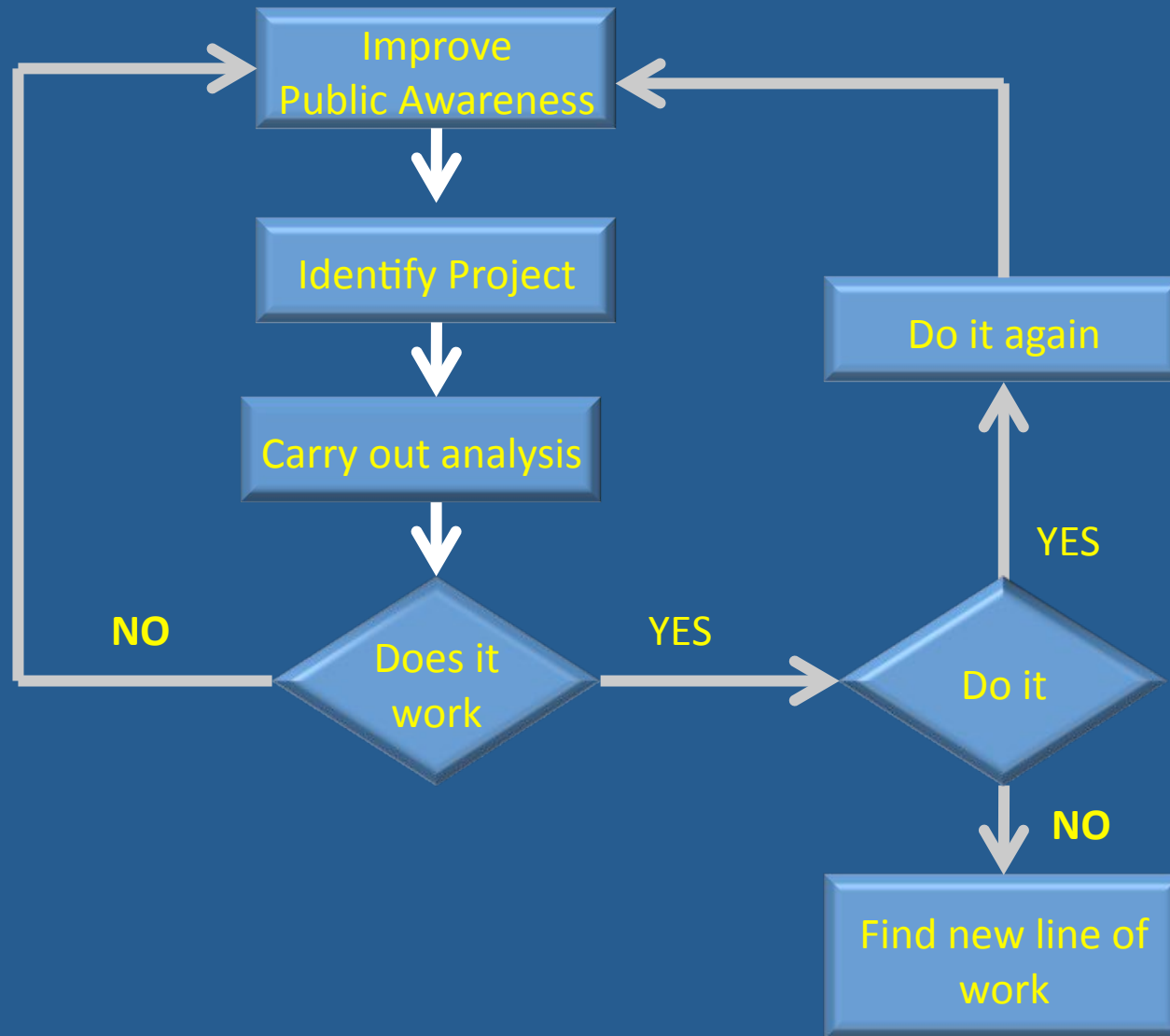
$$\begin{array}{l} \text{Annual cost of fuel} \\ \text{Guaranteed saving/motivation} \\ \text{Budget} \end{array} \quad \begin{array}{c} F \\ GS \\ \hline F-GS \end{array} = \frac{\quad}{\quad} \quad \mathbf{B}$$

$$\begin{array}{l} \text{Capital cost of equipment } CC \\ \text{Loan Repayment} \\ \text{Fuel cost} \\ \text{Labor \& Maintenance} \\ \text{Profit} \\ \text{Annual Cost} \end{array} \quad \begin{array}{c} \\ LR \\ FC \\ LM \\ P \\ \hline LR+FC+LM+P \end{array} = \frac{\quad}{\quad} \quad \mathbf{AC}$$

$$\text{if } X \text{ positive do the job} \quad \quad \quad \mathbf{B-AC} = \frac{\quad}{\quad} \quad \mathbf{X}$$

Roadmap

RENEWABLE
ENERGY
RESOURCES



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ENERGY
RESOURCES



I look forward to your comments and questions