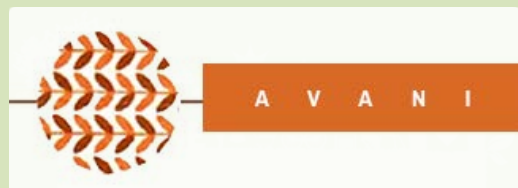




## *Light Coal: Development of a Torrefaction Reactor and Business System for Himalayan India*



**Vidyut Mohan**



# ***Project Introduction***



**66% area covered with forests**

**90% of the area mountainous**

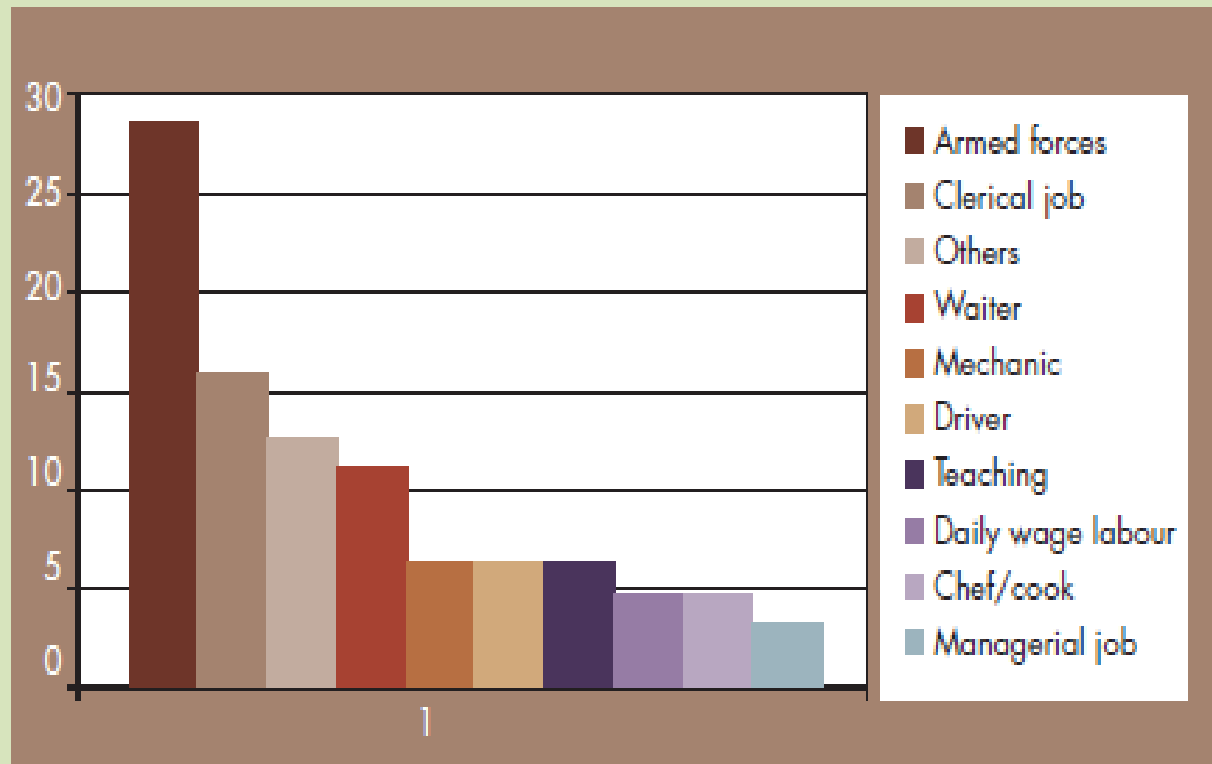
***Avani, Tripuradevi***



# ***Degradation of Forests***



# ***The Need to Combat Outmigration***

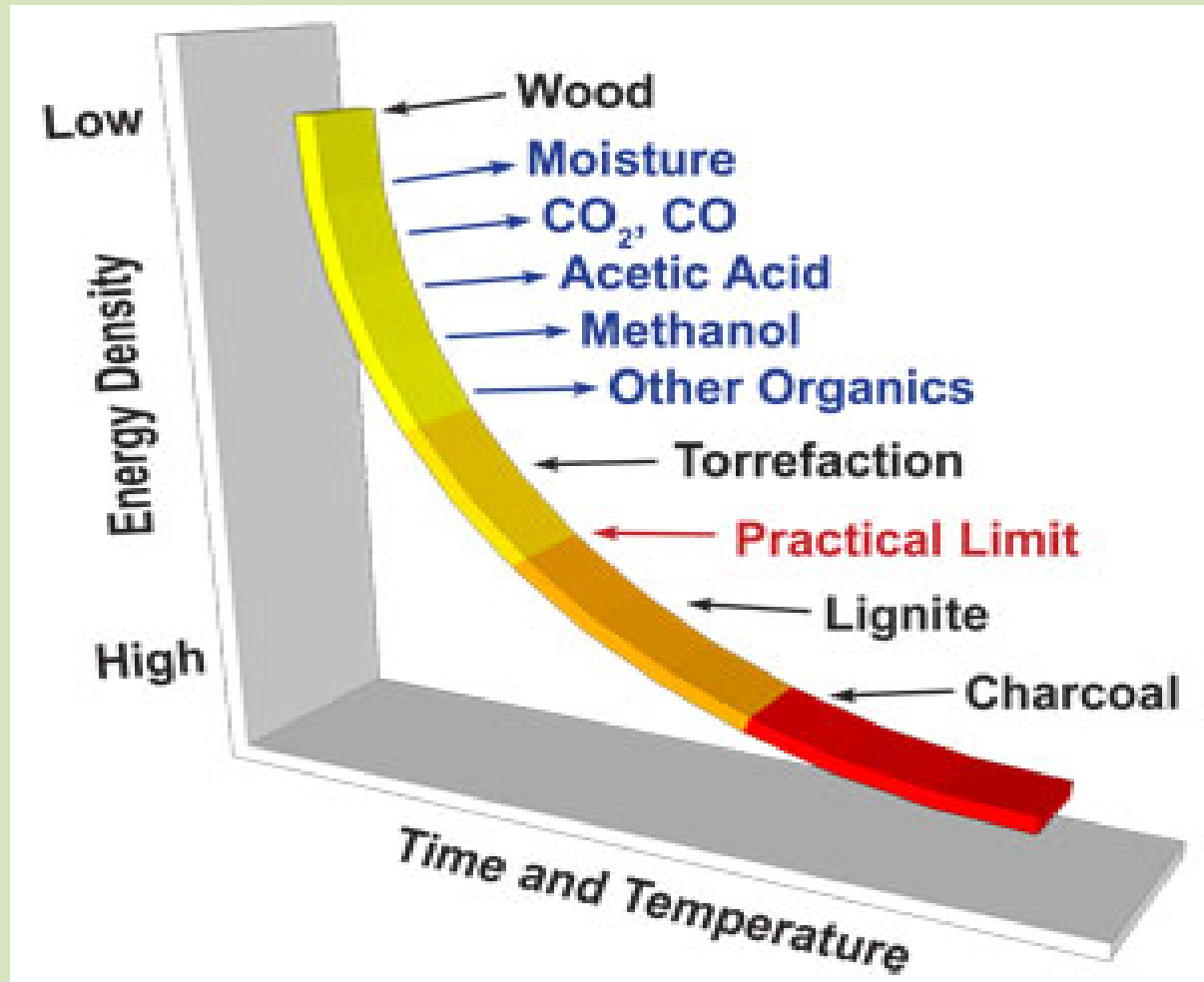


Source: ICIMOD

# ***Our Proposal: Light Coal***



# ***Torrefaction Basics***





# ***Our Goals***





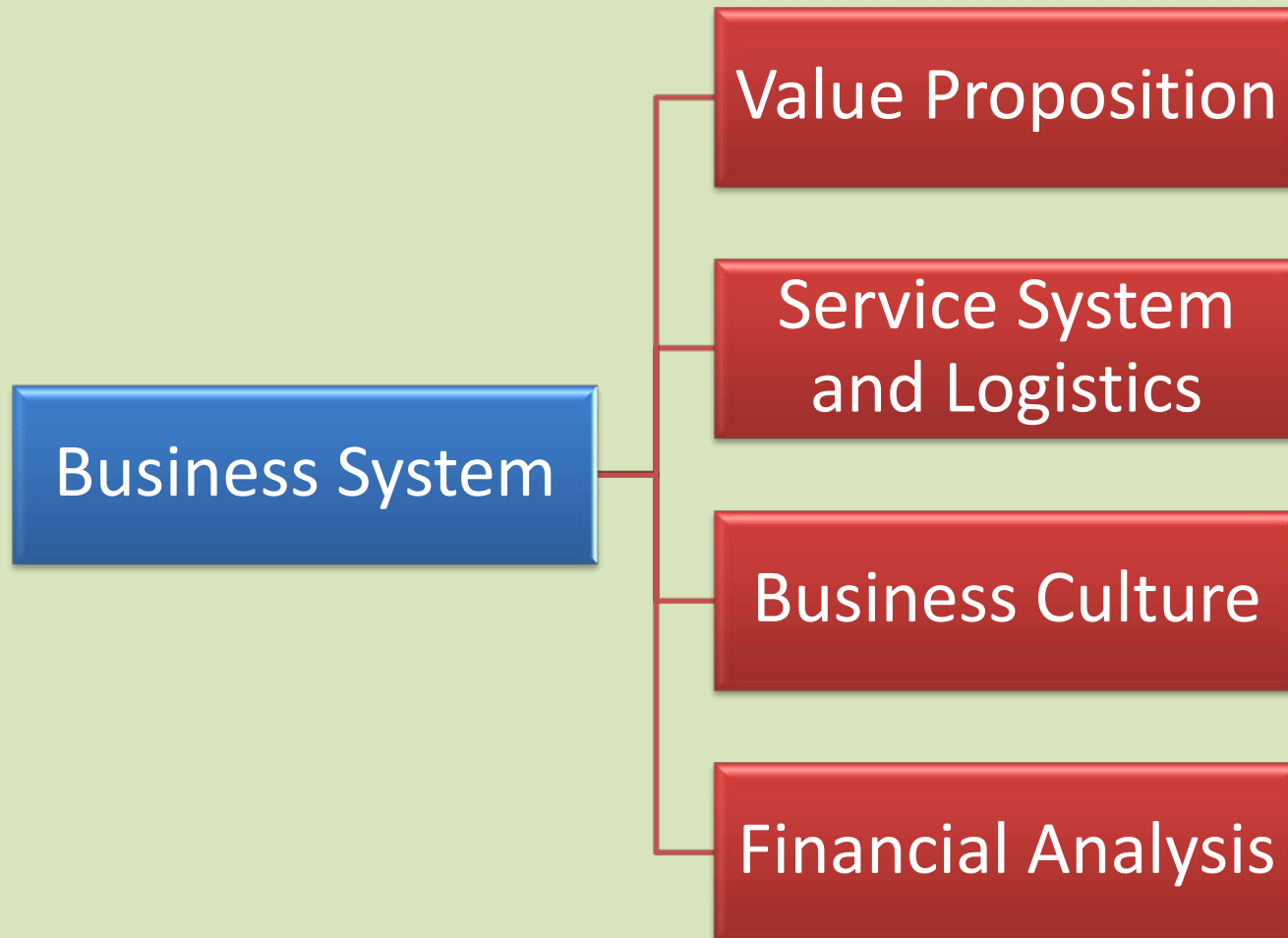


# ***Our Plan***





# ***Business System Design***



# ***Business System Design***

## ***Interviews, Generative Design Sessions, Product Demos***

<b><i>Domestic End Users</i></b>	<b><i>Institutions</i></b>
Villagers	Schools
Peri- urban residents	University campus and its dormitory
Migrant workers	Military campus
<b><i>Small Businesses</i></b>	<b><i>Small Industries</i></b>
Small eating joint ( <i>dhabas</i> ) owners	Workers at Avani's gasification plant
Restaurant owners	Iron smiths
Hotel/resort owners	Biscuit factory
	Dairy Plant
<b><i>Fuel Outlets</i></b>	<b><i>Financial Institutions</i></b>
LPG warehouses	State Bank of India regional office, Almora
Kerosene/LPG ration shops	Uttarakhand Grameen Bank, Pithoragarh
<b><i>Government Officials</i></b>	<b><i>Non- Governmental Organizations (NGOs) in Kumaon</i></b>
Divisional Forest Officer (DFO) and Forest Ranger, Almora	Various managers and workers at Avani Kumaon, Tripuradevi
District Magistrate of Almora	Founders of Himalprakriti, Munsiyari
<i>Van panchayat</i> (village forest council) sarpanch (head) of Bhandari Village	Founder of Aarohi, Sitoli village
<i>Gram Pradhan</i> (village council head) of Belada Agar Village	Other social activists and people knowledgeable about the local context

# ***Business System Design***

## ***Interviews, Generative Design Sessions, Product Demos***





# ***Business System Design***

## ***Interviews, Generative Design Sessions, Product Demos***





# ***Business System Design***

## ***Interviews, Generative Design Sessions, Product Demos***





# ***Business System Design***

## ***Interviews, Generative Design Sessions, Product Demos***





# Technical Design

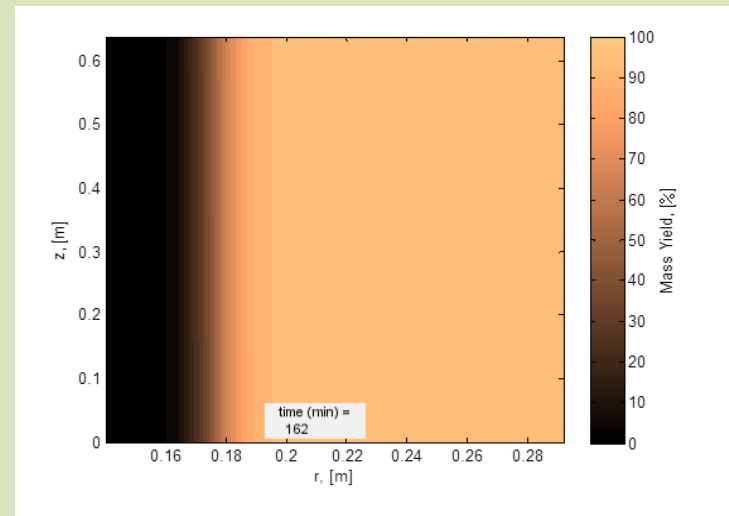
## Methodology

### Prototype:

- Design
- Construction
- Testing



### Pine Needle Experiments



### Computerized Simulation

# ***Manufacturing and Testing***

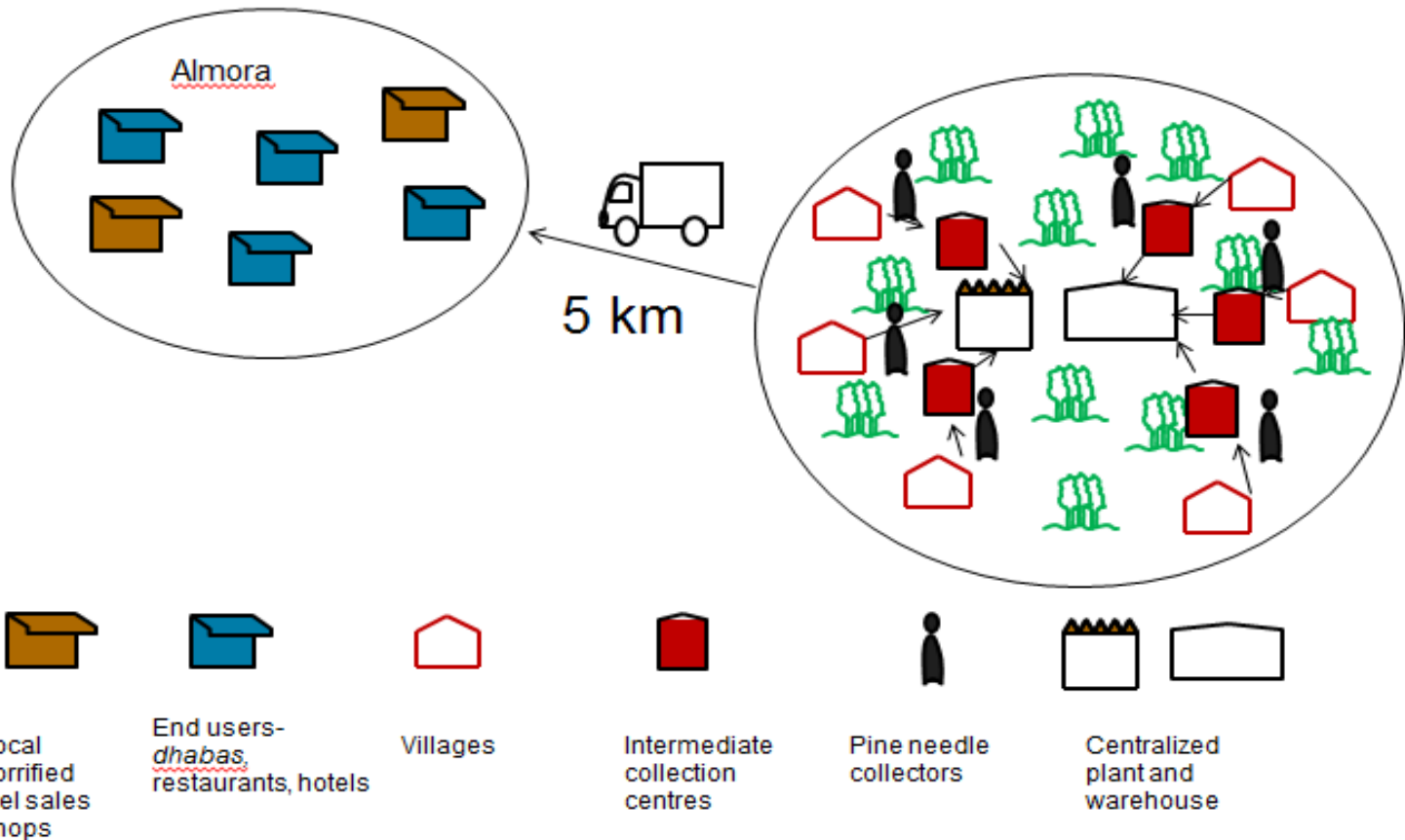


# ***Experimental Results***

<b><i>Residence Time</i></b>	<b><i>15 minutes</i></b>	<b><i>30 minutes</i></b>	<b><i>45 minutes</i></b>
<b><i>Temperature</i></b>	<b><i>Profit (10<sup>6</sup> Rs/year)</i></b>	<b><i>Profit (10<sup>6</sup> Rs/year)</i></b>	<b><i>Profit (10<sup>6</sup> Rs/year)</i></b>
<b><i>230°C</i></b>	1.47	1.37	1.32
<b><i>250°C</i></b>	1.28	1.16	1.07
<b><i>270°C</i></b>	1.01	0.84	0.74
<b><i>290°C</i></b>	0.58	0.37	0.19



# Biomass Collection and Fuel Distribution



***Thank You!***

