



Small-scale, decentralized biomass upgrading

*Presented by
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More than \$120 billion/year of biomass is burned



Current **paradox**

Biomass serves as the feedstock to many important industries

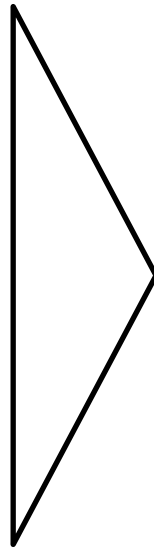
Forestry residues



Biomass



Agricultural residues



Renewable
energy

Activated
chemicals

Biofuels

Fertilizer

Plastic
additives

Logistical **challenge**

Biomass is loose, wet, bulky, and expensive to transport.



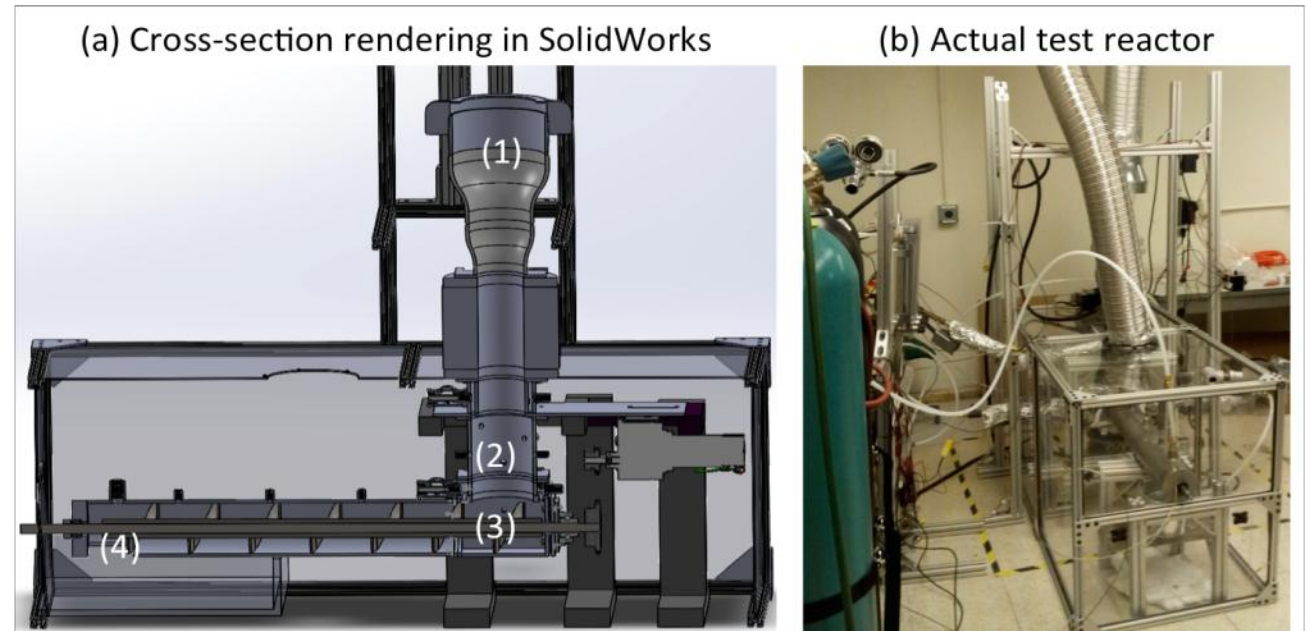
Our solution

Low-cost, small-scale, portable systems to convert biomass at source



- Latched onto tractors, trailers, or shipping containers
- Requires no external heat/fuel (autothermal)

Raw Biomass	Densified Biomass
Loose and bulky	Volume reduction by 600%
Costly to transport	Reduces transport cost by 40%



Competitive advantage

Our design simplifies the reactor design and makes it flexible

Requirements	Competitors	Takachar system
Gas reactant	Heated special gases	Room temperature air
Gas handling	Scrubbing, drying	None

Market segmentation

We will first target the filtration and remediation sector.

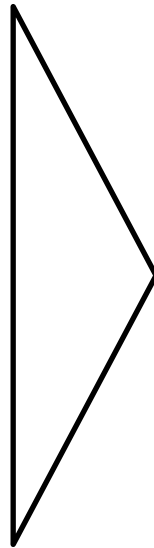
Forestry residues



Biomass



Agricultural residues



Renewable
energy

Activated
chemicals

\$5 billion/year
12% growth

Biofuels

Fertilizer

Plastic
additives

Customer persona

Ramesh Chandra Shah |
Small-scale producer of biomass-based activated carbon

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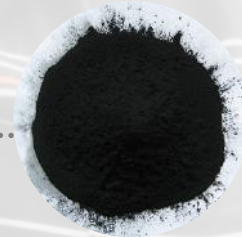
Activated carbon is a \$5 billion/year value chain, 12% CAGR



Biomass



Charred
precursor



Activated
carbon



Filtration
Purification

Customer **pain**

Ramesh's current profit margin is razor-thin.

Ramesh's status quo

Revenue: \$280,000/year

Input costs: \$250,000/year

Net: \$ 30,000/year
(±60,000/year)

Value proposition

We triple Ramesh's net income.

Ramesh's status quo

Revenue:	\$280,000/year
Input costs:	\$250,000/year
Net:	\$ 30,000/year (±60,000/year)

Takachar's system

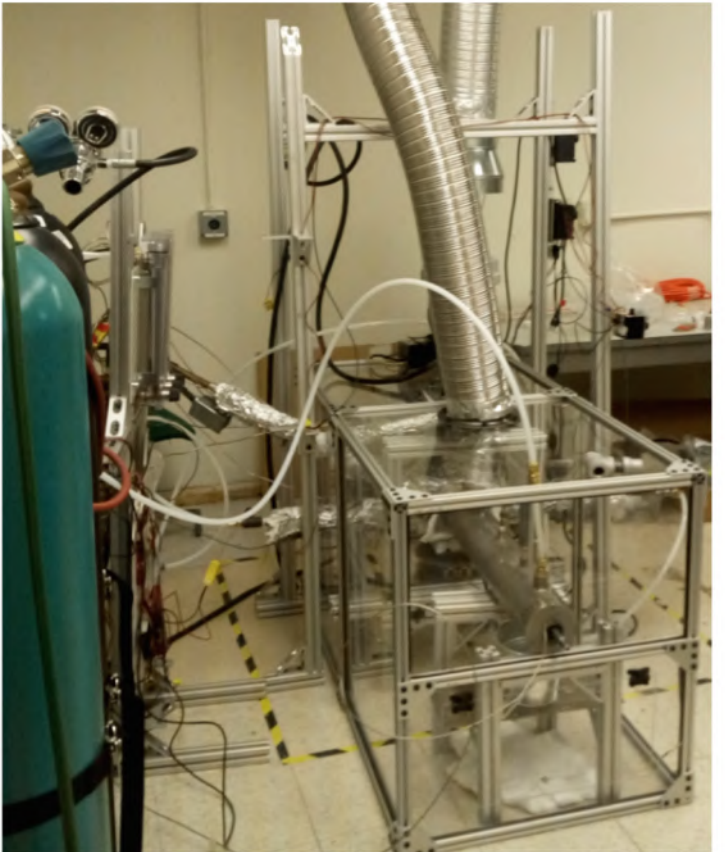
Revenue:	\$280,000/year
Input costs:	\$200,000/year
Net:	\$ 80,000/year

A saving of \$50,000/year per customer per system

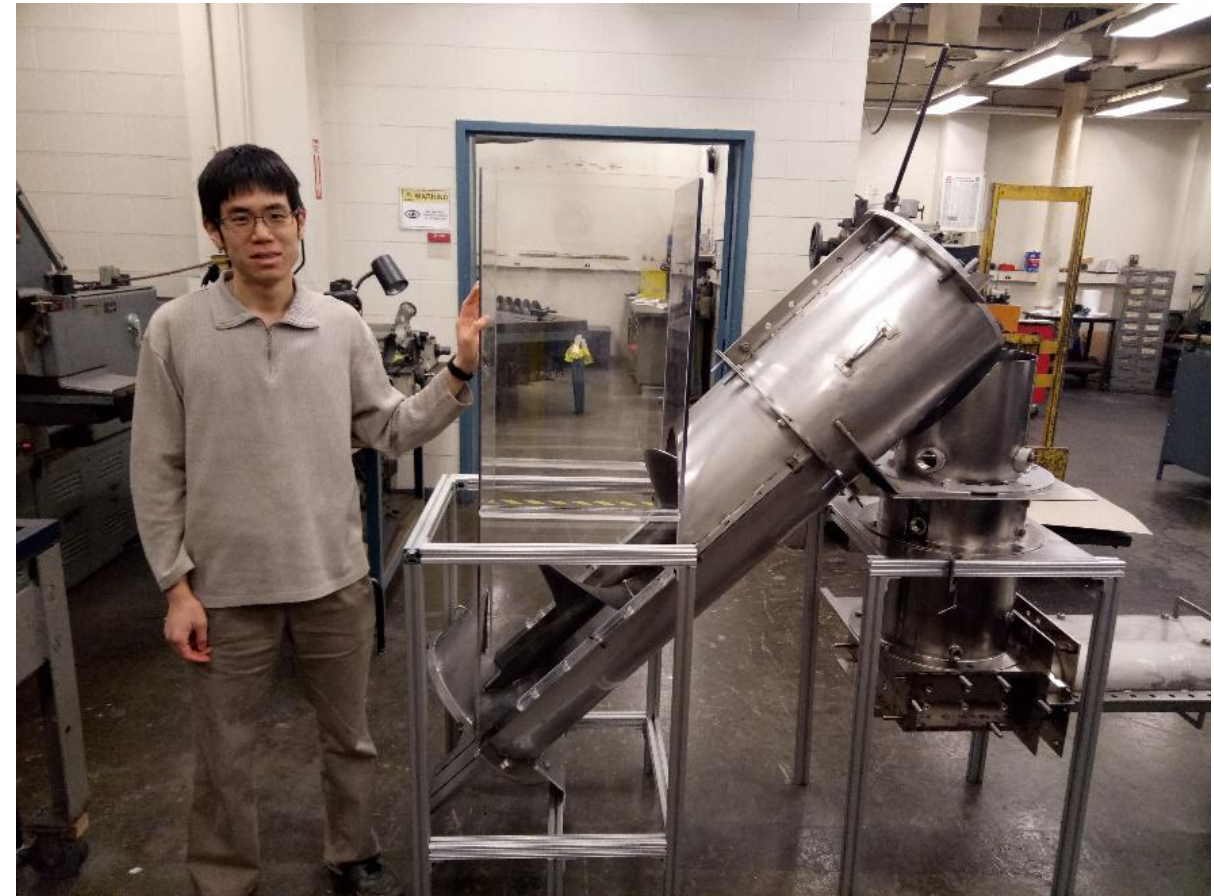
Prior achievements

We completed a 10x scale-up prototype during Q2 2018.

Lab prototype (“NanoTorr”)

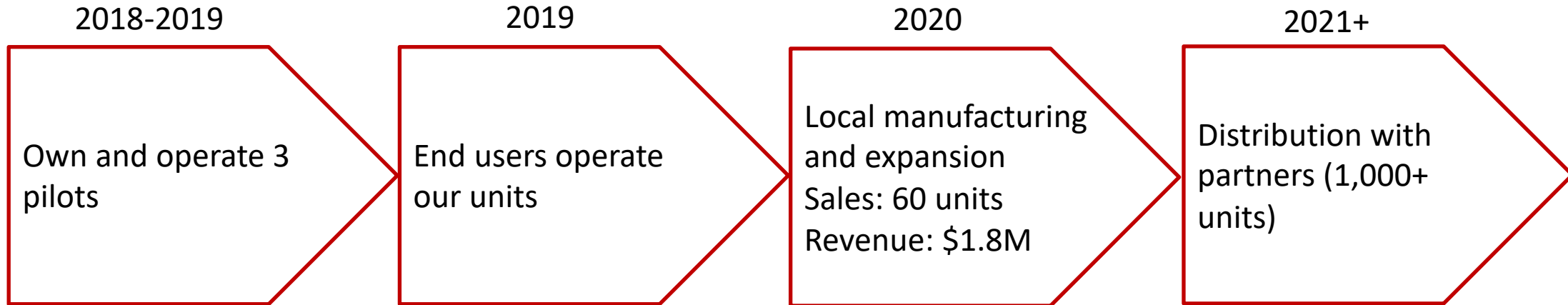


Pre-commercial prototype (“MicroTorr”)



Path to **impact**

We'll manufacture and distribute our equipment with partners



Ministry of Agriculture & Farmers Welfare, Government of India
Coconut Development Board



At-scale **vision**

We serve biomass generators and consumers worldwide

Forestry residues

Mitigation of 100 million tons of CO₂ equivalent



Agricultural residues

Renewable
energy

\$2 trillion/year, 2% growth

\$3 billion/year (U.S.)

Fertilizer

Biofuels

Other
chemicals

\$168 billion/year, 5% growth

Acknowledgements



Liebmann Fund



cyclotronroad

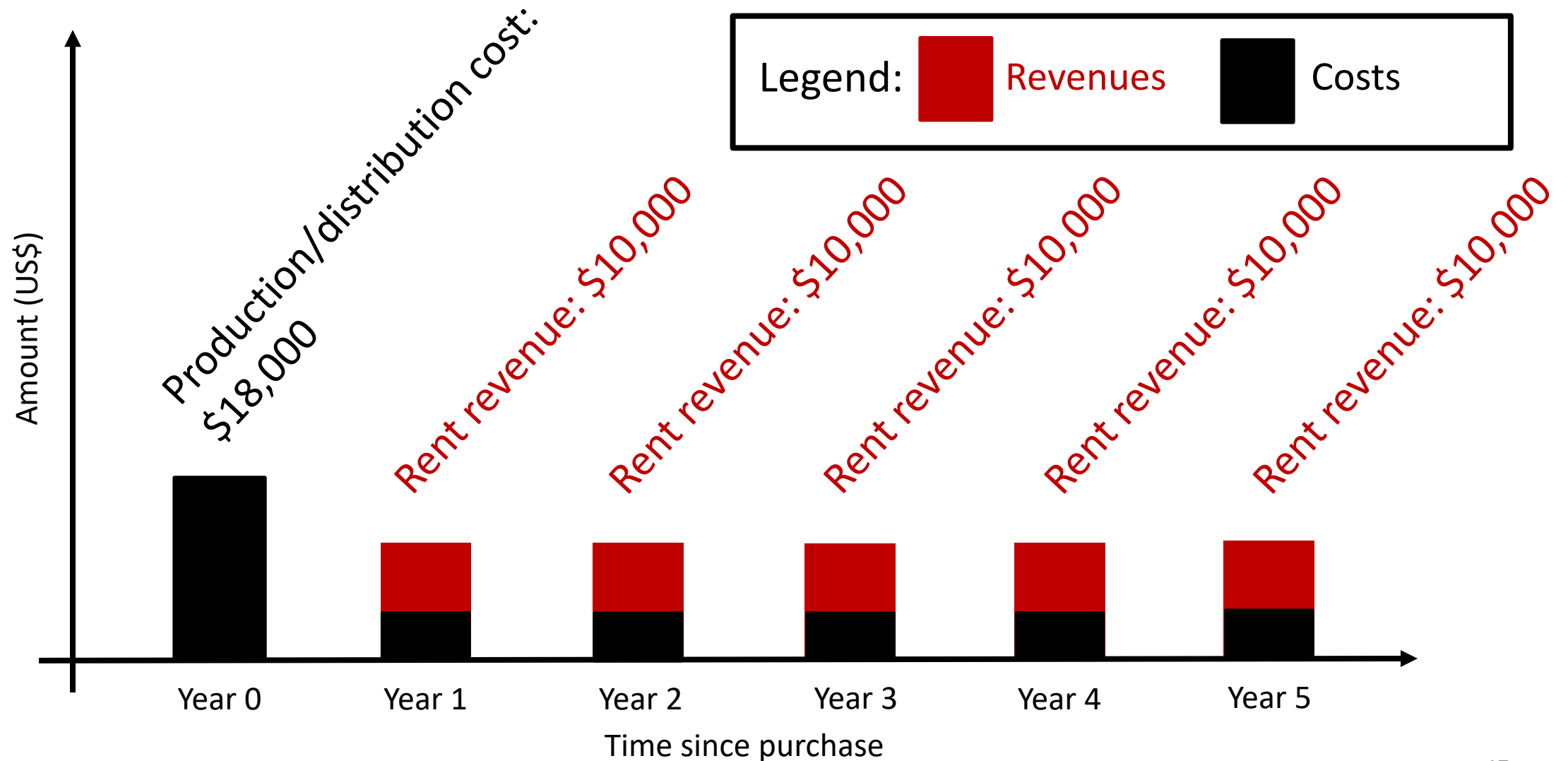


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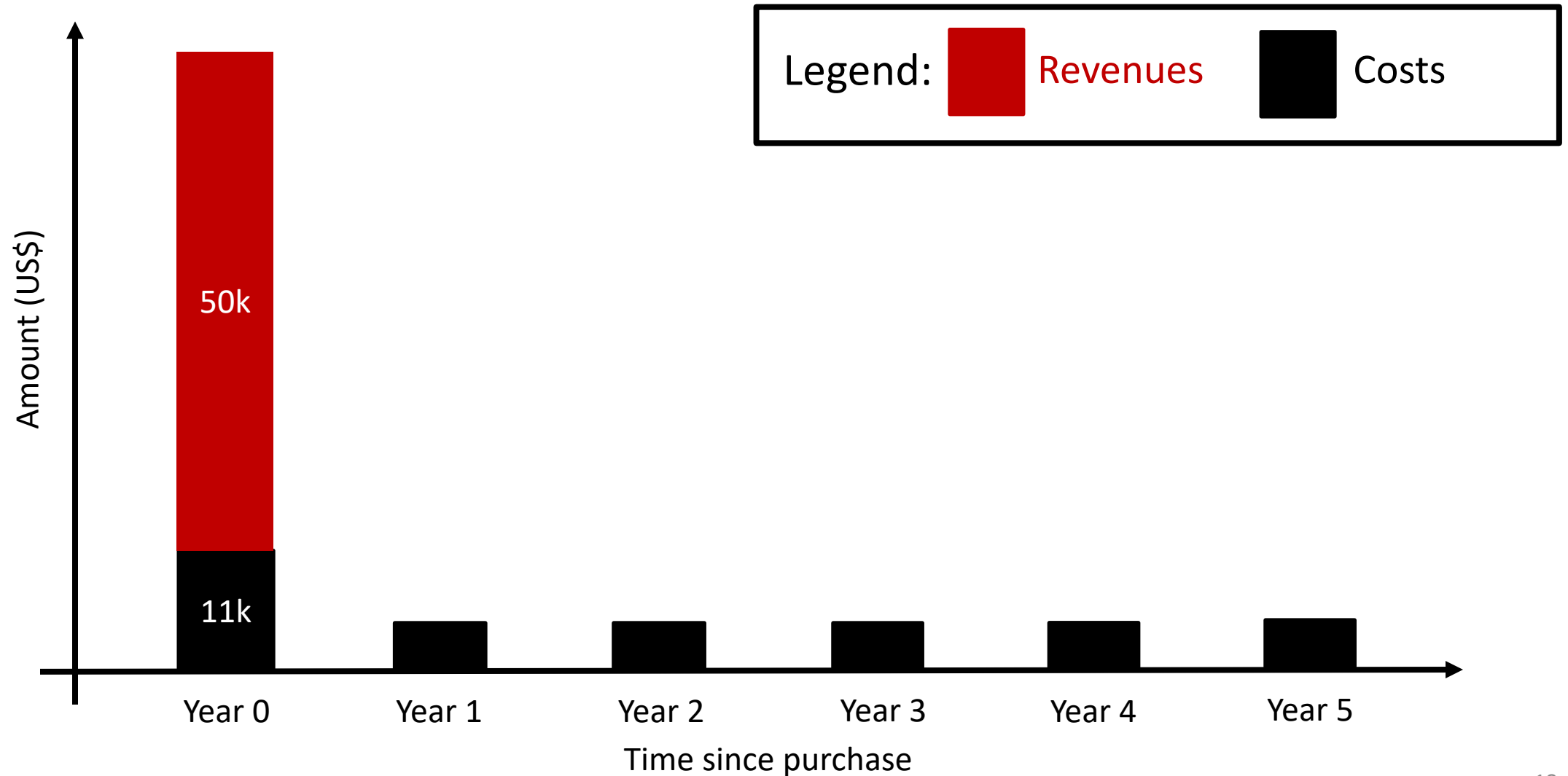
Pricing **strategy**

Rent-to-own model (early stage)



Pricing **strategy**

Capital purchase model (scale-up)



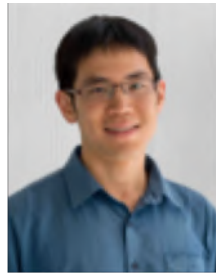
Team Takachar



Yash Shah
MS Industrial
Engineering &
Supply Chain



Adesh Mehta
MS Energy Systems, MIT PhD on
MBA, beachhead technology, prior
market connections biomass company



Kevin Kung
MIT PhD on
technology, prior
biomass company

Partners



Reactor
scaling



Control
strategy



Local
manufacturing

Technical Advisors



**Dr. Robert
Stoner**
MIT Energy
Initiative



**Prof. Ahmed
Ghoniem**
Biomass energy



**Dr. Jason
Prapas**
Cleantech
investing



Tani Chen
IP counsel
for university
spinouts



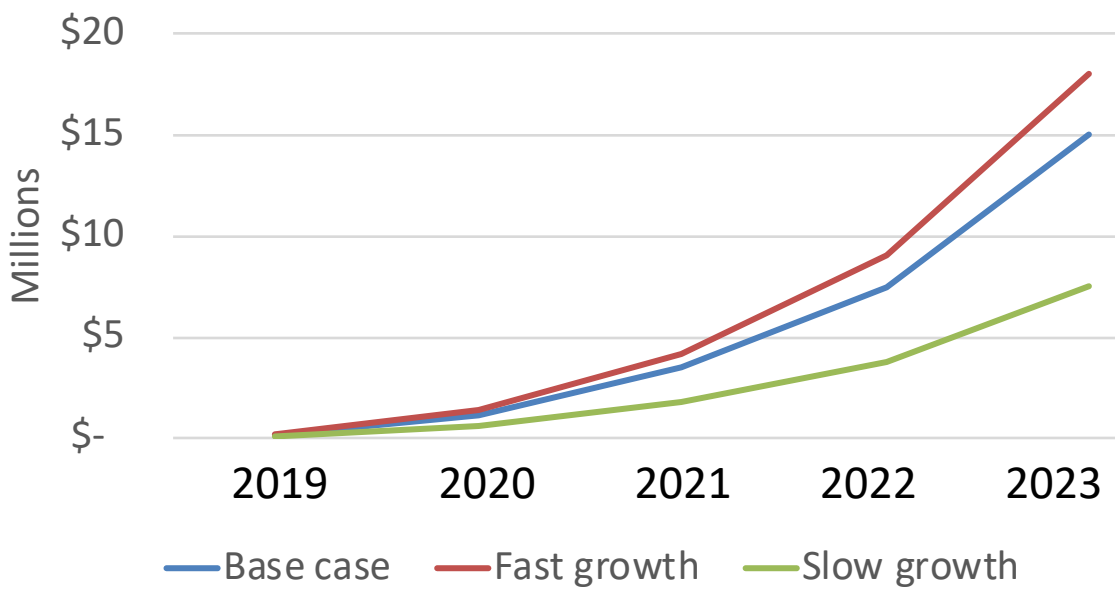
**Michael
Chester**
International
manufacturing
deployment



**Felicity
Lodge**
Rural market

Growing impact

Projected growth



Social and environmental impacts

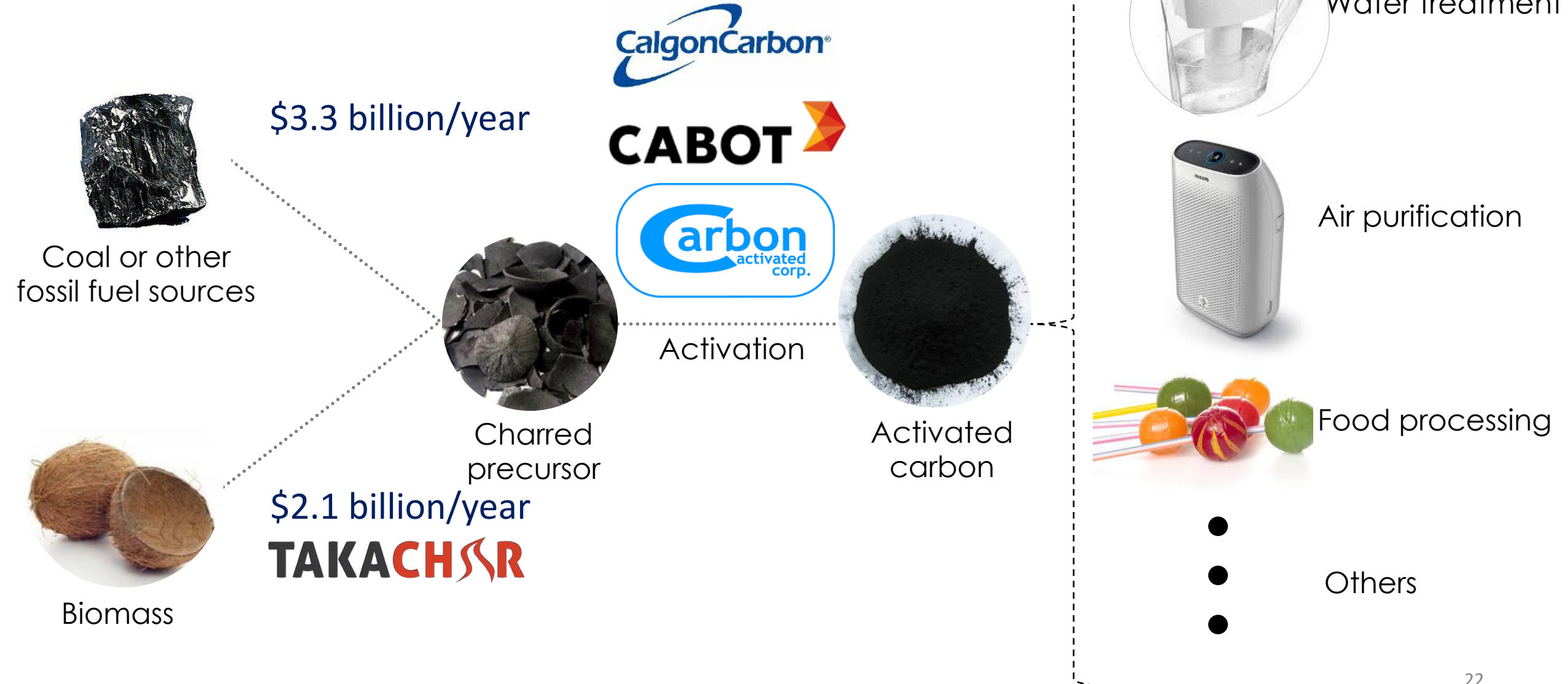
	2019	2024
Units deployed	5	3,600
Farmers impacted	50	900,000
Rural value addition	\$250,000	\$13 million
Tons CO ₂ e mitigated	16,000	17 million
Tons of waste managed	7,500	8 million
Tons of particulates averted	4.3	4,600

Preliminary manufacturing



Activated carbon

And its \$5 billion/year value chain



Source: BCC Report (2018)

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Prior achievements

In Q2 2018, we raised \$400,000 in grants



\$25,000



\$70,000



\$300,000

With another \$850,000 of grants in the pipeline.