

# Reducing environmental pollution while creating novel value propositions for livestock manure management

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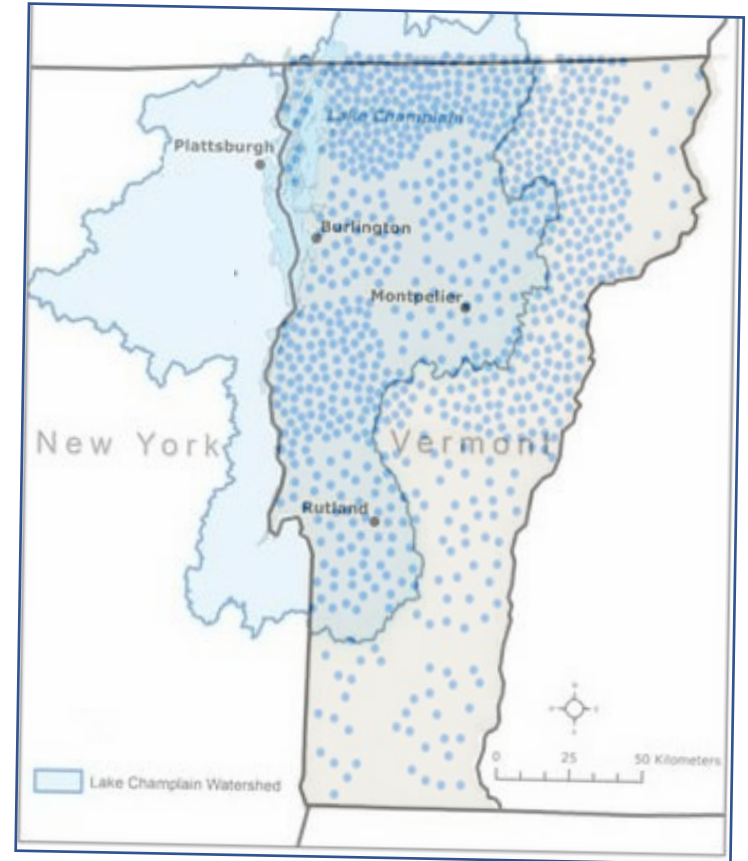
# Project overview



## Aims:

- Provide dairy manure management solutions to small-to-mid sized dairy farms using standard, pre-fabricated systems
- Reduce the environmental pollution caused by dairy manure (primarily GHG and excess nutrients)
- Improve farm economics for manure management

Manure dewatering and pyrolysis units installed at farms initially in Vermont and Connecticut.



# Current challenges in dairy manure management

1

Livestock manure management = 1.3% of total GHG emissions in the U.S.

2

Potential watershed nutrient pollution caused by excess nutrient leaching

3

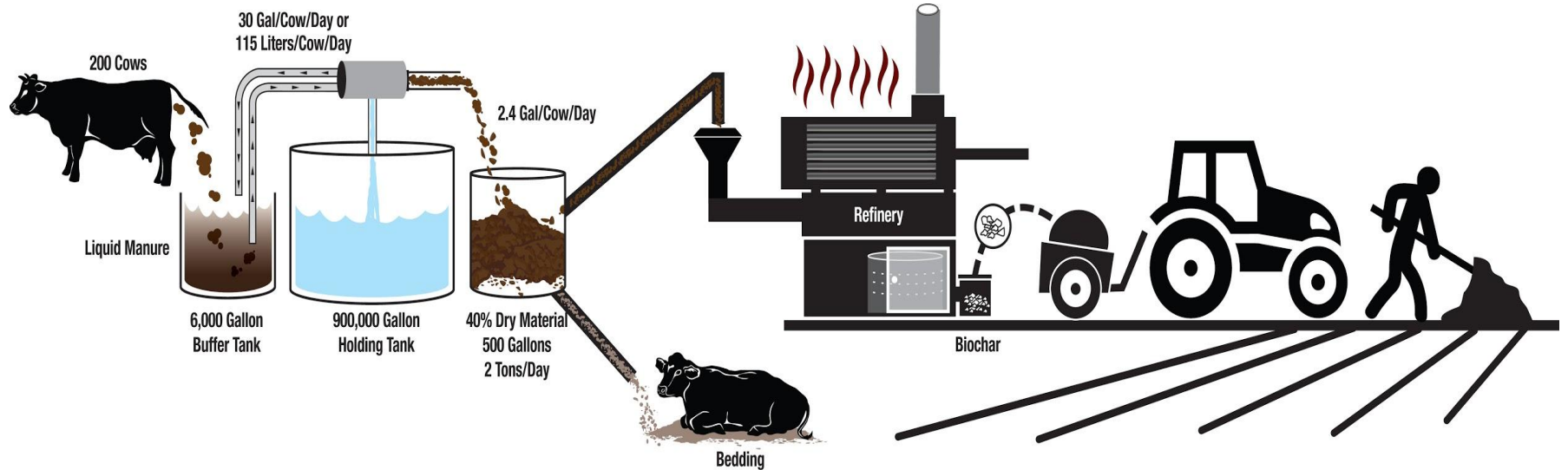
Anaerobic digesters: limited application at small farms

4

Dewatering manure:

- Up to 40% reduction in GHG emissions
- Bulky material with no clear market

# Proposed solution: dewatered manure pyrolysis



# Screw press separator



# Dewatered manure





# The Biogenic Refinery



- 01 | Decentralised small-scale pyrolysis system
- 02 | Experience treating human faecal sludge, similar characteristics to dairy manure
- 03 | Integrated air emissions control technology
- 04 | Remote monitoring capabilities



# Data collection and remote monitoring

## Sensors



- Temperature (air and water)
- Oxygen levels
- Flow rates
- Power usage

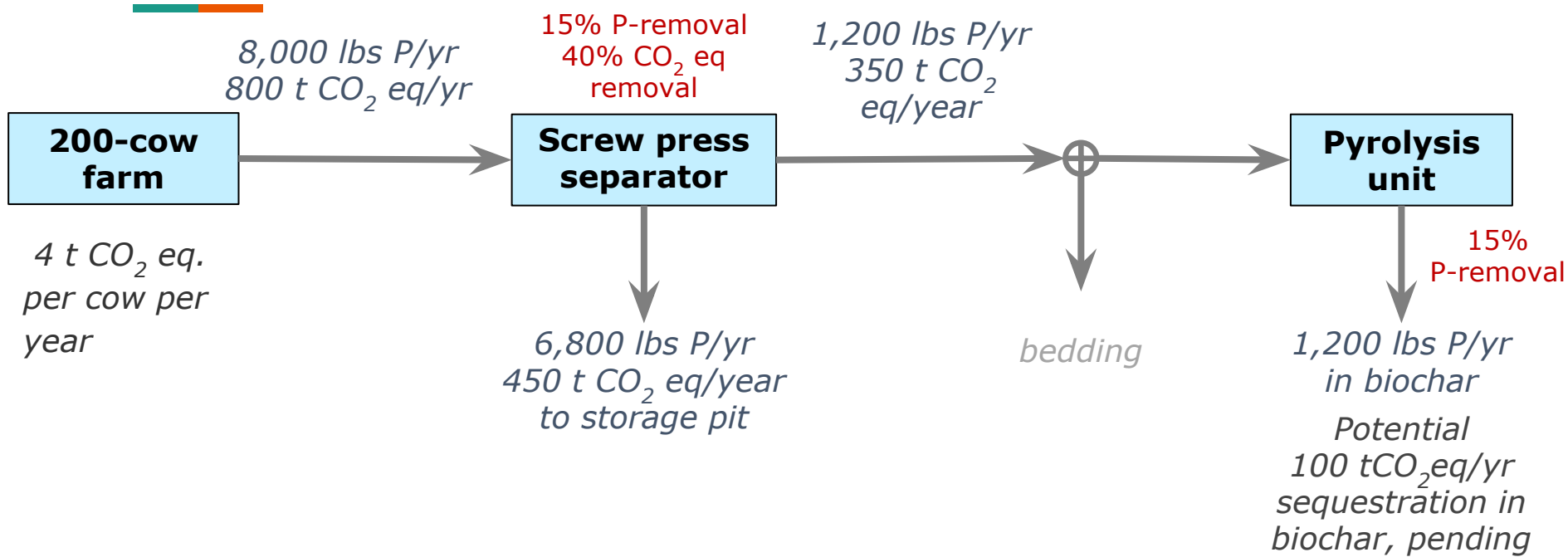
## Database and kelv°n



- MySQL relational cloud database
- Real-time data access
- Web and mobile app, kelv°n: <https://kelvinapp.io/>



# 200 cow dairy farm: Carbon and Phosphorus balance



Quantified GHG reductions = project financing through carbon trading mechanisms

# Expected benefits and challenges

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1

Positive environmental impact:

- Reduction in GHG emissions in dairy farms using well understood equipment and recognized carbon protocol
- Potential reductions of excess nutrients at farms
- Air emissions control from pyrolysis unit

2

Produce valuable products:

- Biochar: low volume, can potentially be used on the farm
- Dewatered solids for bedding
- Potential excess heat

3

Carbon financing as an enabling mechanism for an aggregated program of small-scale GHG reduction projects

4

Site-specific scoping and preparation required

# Long term vision

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- 01 | Expansion to other regions of small dairy farms (about 50,000 small dairies in U.S.)
- 02 | Application in similar sectors (e.g. hog farm manure management)
- 03 | Additional revenue for farms in the challenging milk market (recent 6.8% drop in number of dairy farmers in the U.S.)
- 04 | Standardization to bring long term costs down
- 05 | Potential for carbon validation/verification relating to carbon sequestration of biochar, and resulting increased carbon market value of project

Thank you!



# 200 cow dairy farm example: mass flow

DM: Dry Matter  
MC: Moisture Content  
TS: Total Solids

