

Biogas in Nepal

Project Partners:

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Waltech Systems – Karl Walter

Cheryl Weyant – Independent consultant

Nick Lam – Independent Consultant

Basudev Upadhyay – Independent Consultant

GACC - Global Alliance for Clean Cookstoves

CCAC - Climate and Clean Air Coalition

Mountain Air Engineering Research Interests

- Biogas
- Emissions Equipment
- ISO TC285 WG3 Cookstove Field Testing
- Water Quality

Equipment: Ratnoze Dilution Sampler



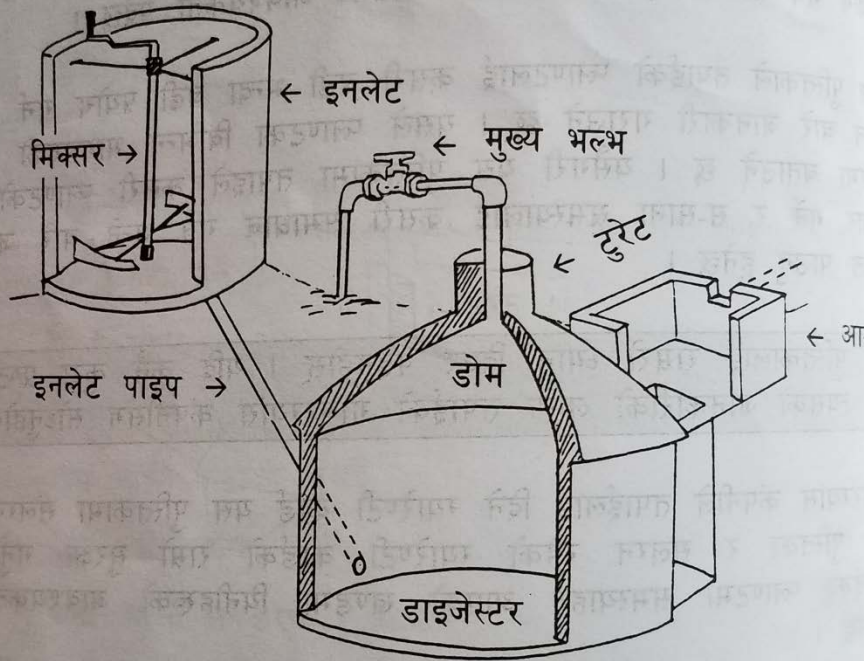
Nepal Biogas Measurements

- Biogas Stove Performance:
 - Emissions BC, EC, OC, CO
 - Fuel consumption, power
 - Usage
- Biogas Digester Performance:
 - Biogas production rate
 - composition
 - energy content
- Biogas System Usability

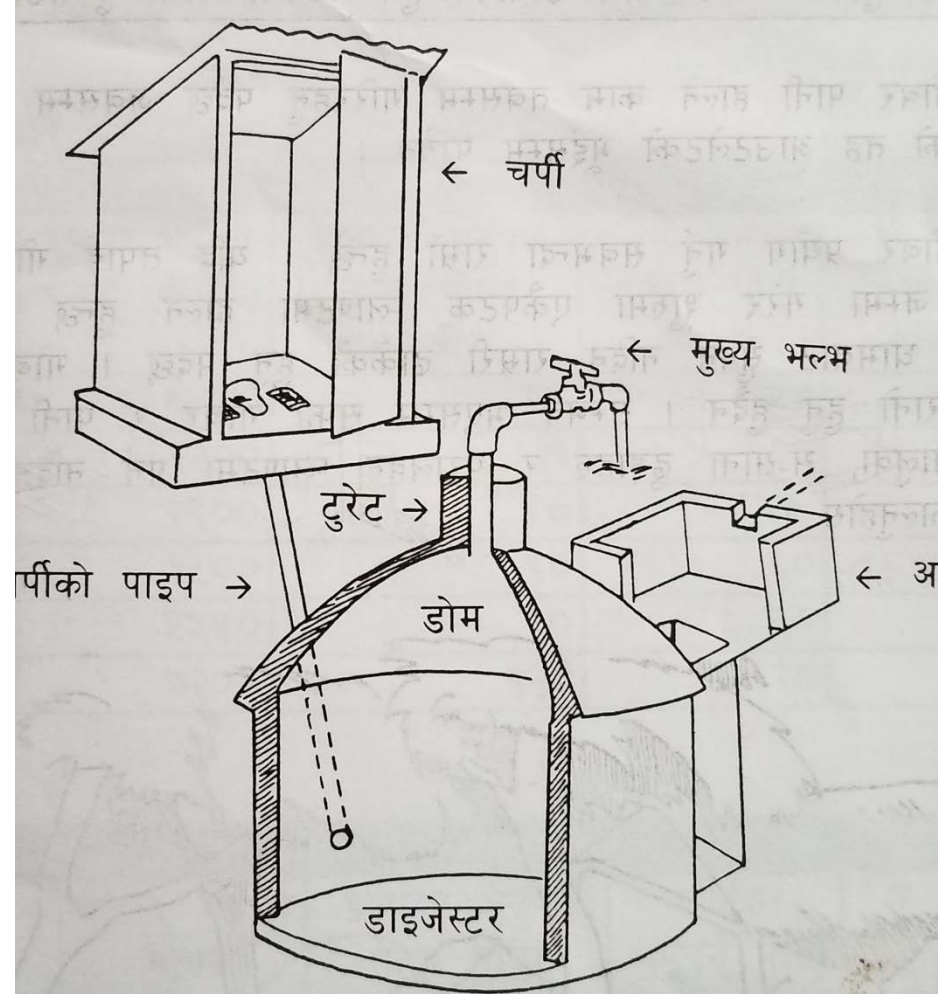
Nepali Homes



Nepal Biogas System

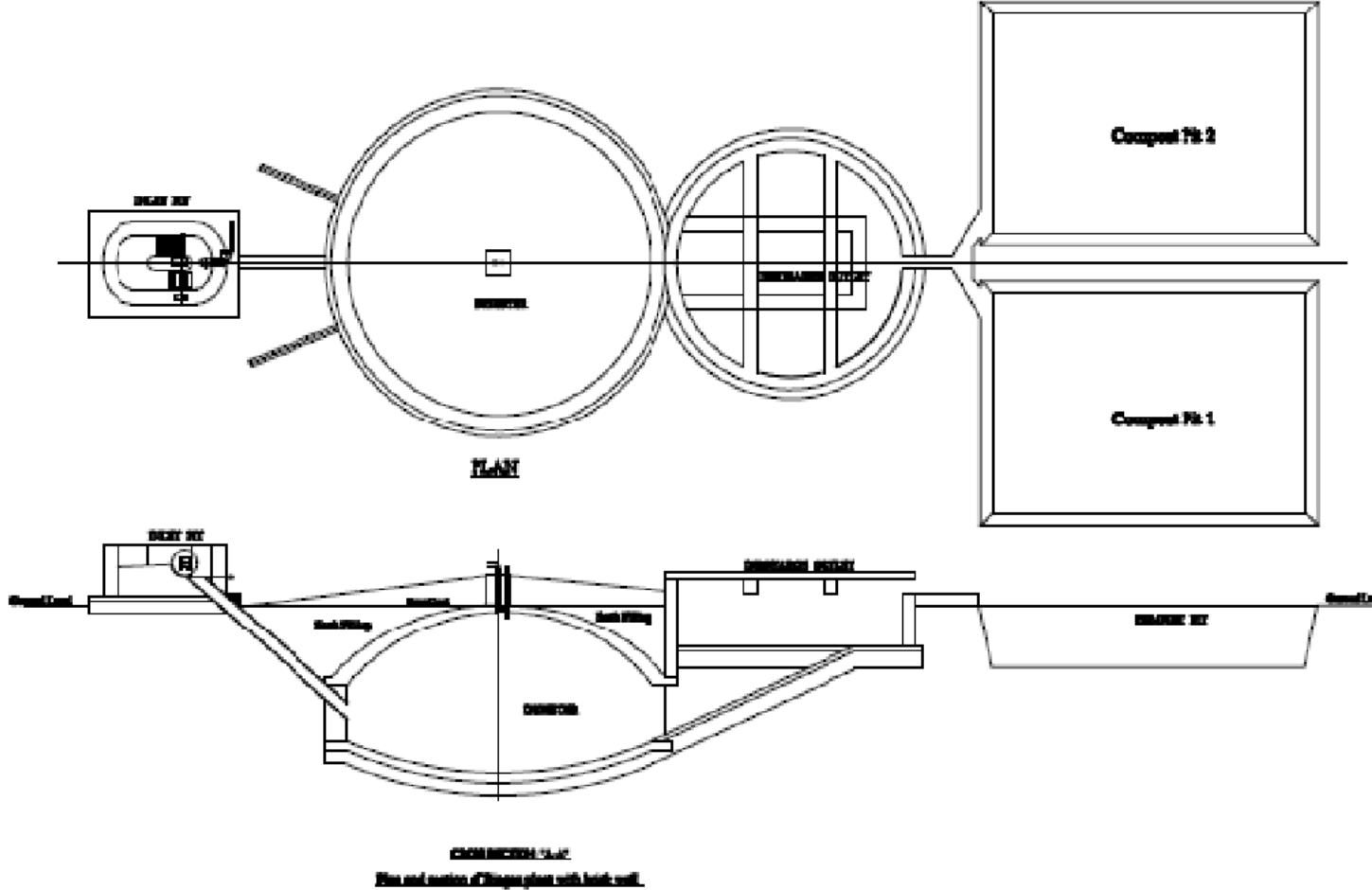


चित्र नं.१ गोबरग्यांस प्लाण्टका विभिन्न भागहरू



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AEPC Biogas Plant Construction Manual



Nepali Biogas System



Nepali Biogas System



Nepali Biogas System



Compost Pits



Upriver biogas system



Emission Equipment: Fumitron (From University of Illinois)

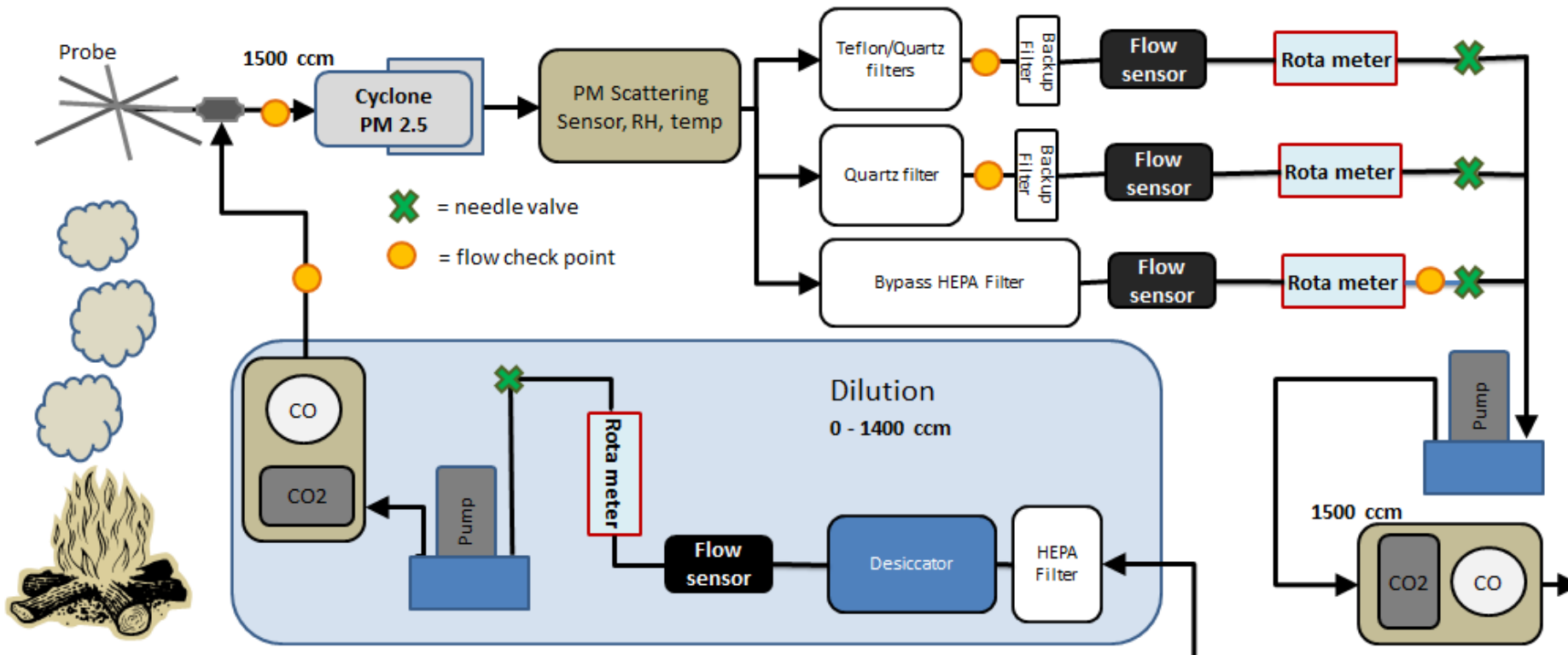
Measures:

- CO
- CO₂
- PM optical scattering
- PM filter samples

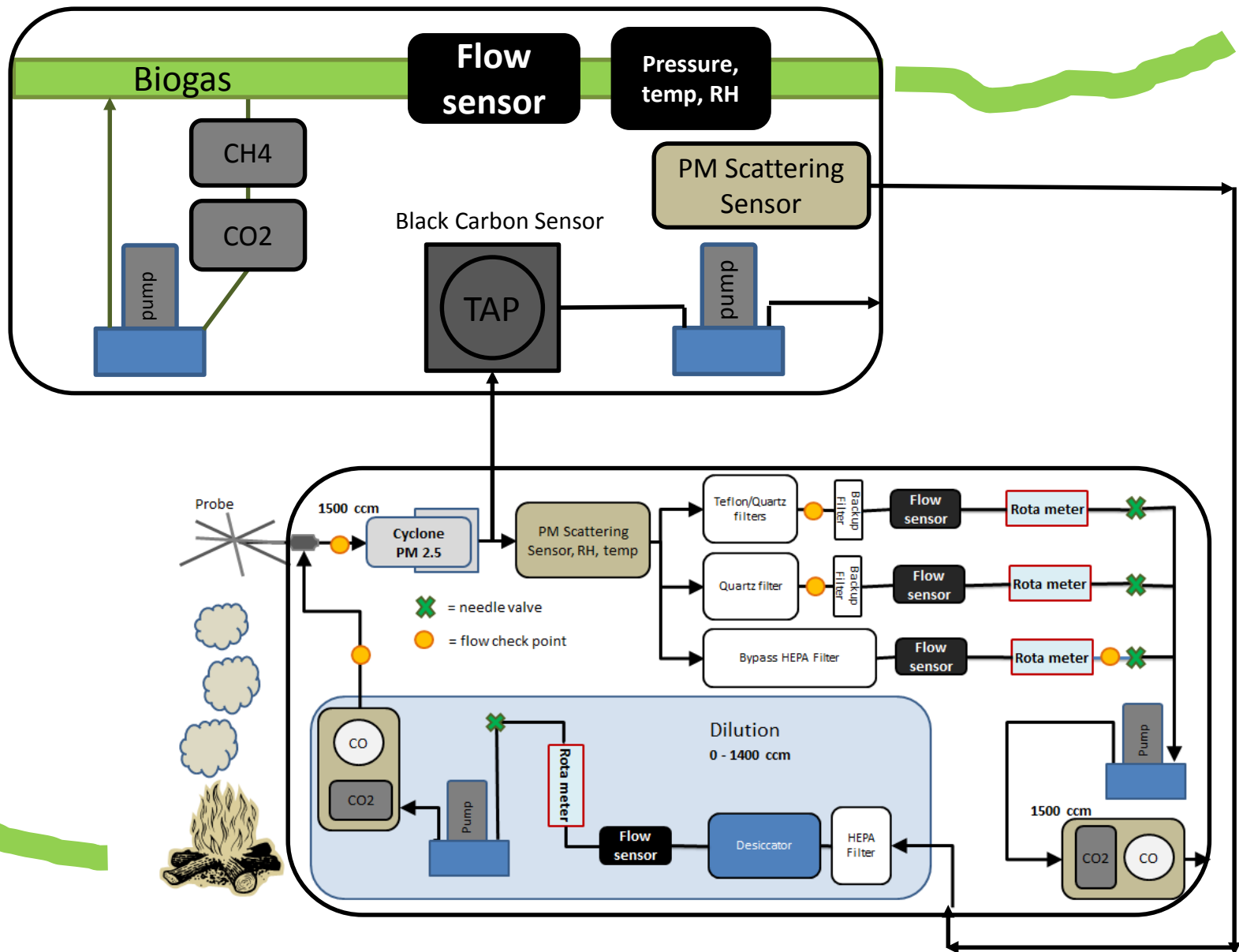
Features:

- Dilution sampler for climate-relevant particle emissions
- Partial capture probe used with carbon balance

Emission Equipment: Fumitron (From University of Illinois)



Equipment: Musakonak Gobargas



Other Equipment

Stove usage temp loggers:

SUMs (iButton)

DIGITs (www.labjack.com)

Household fuel consumption: Biogas flow monitors

Background PM: Hapex (Climate Solutions Consulting)

Biogas stove



Biogas stove



Biogas Stove



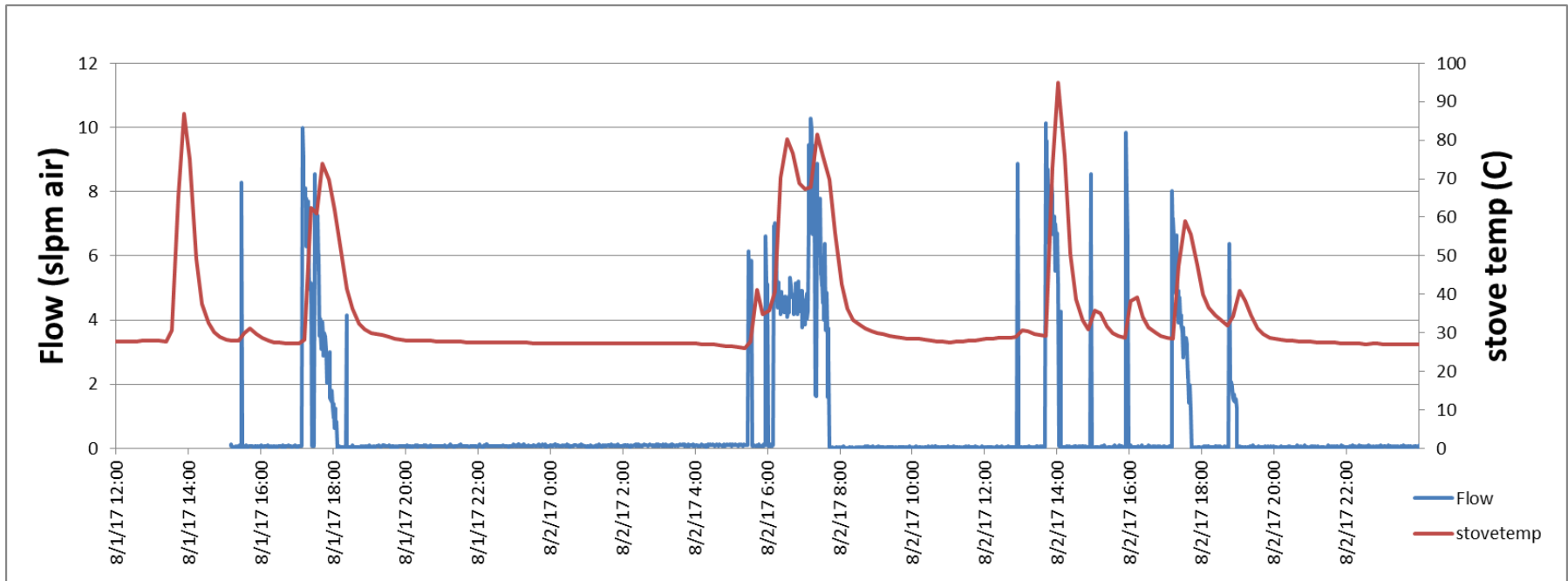
Wood stove



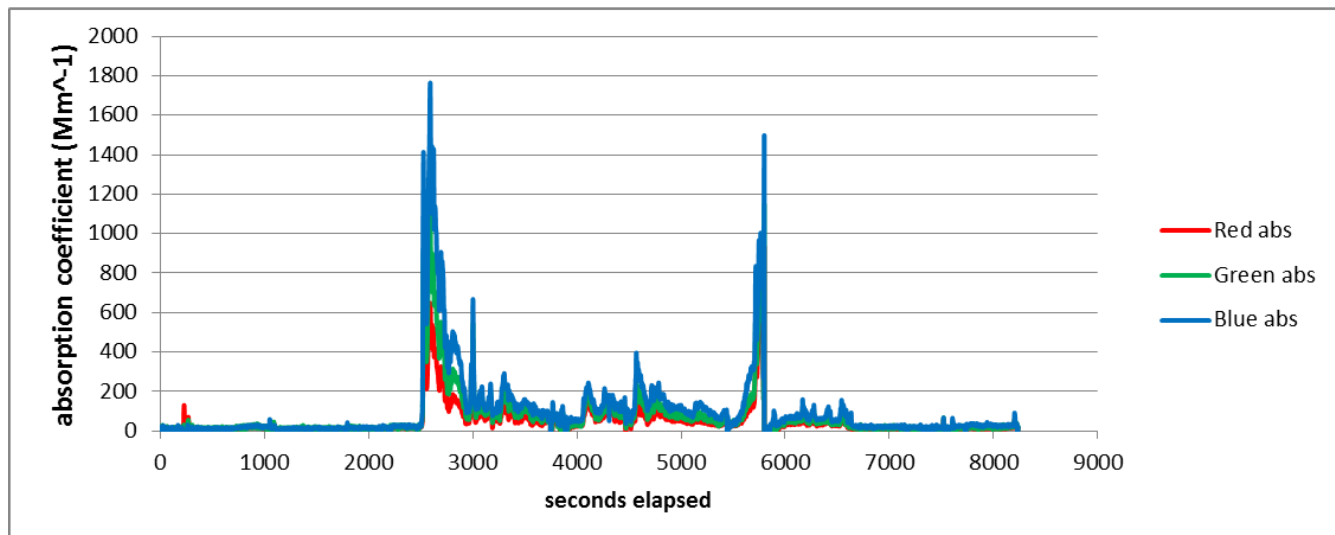
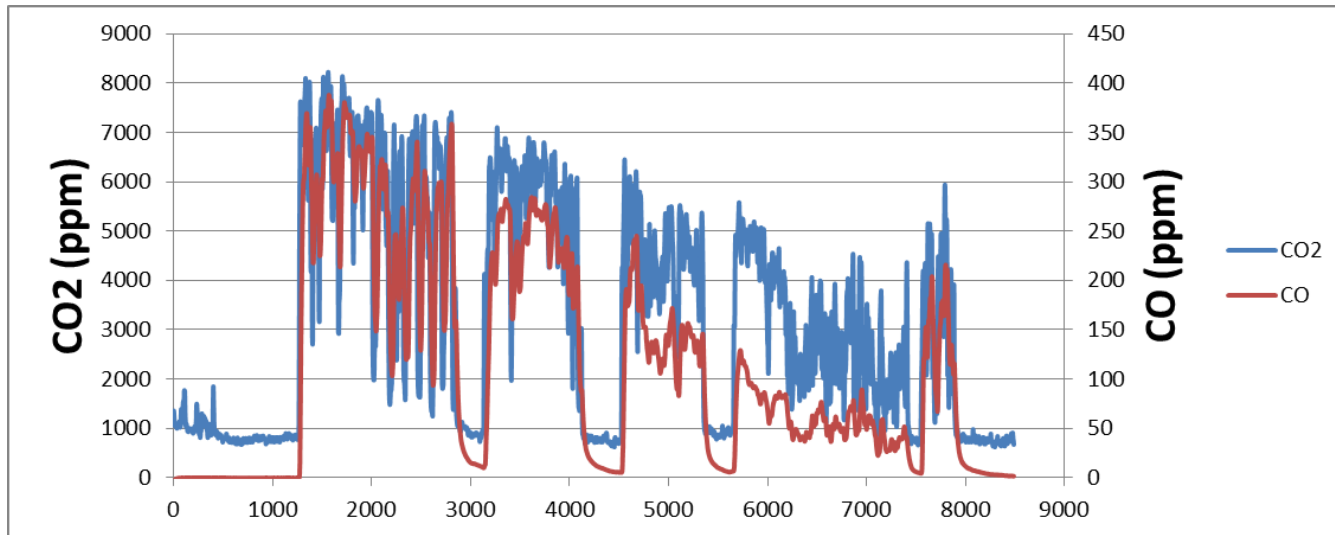
Wood stove



Example Data – Biogas Flow Monitors and Stove Temp Loggers



Example Data: Emissions



Results

- Energy-based emission factors (g/MJ)
- Emission rates (g/min)
- Village level emission rates

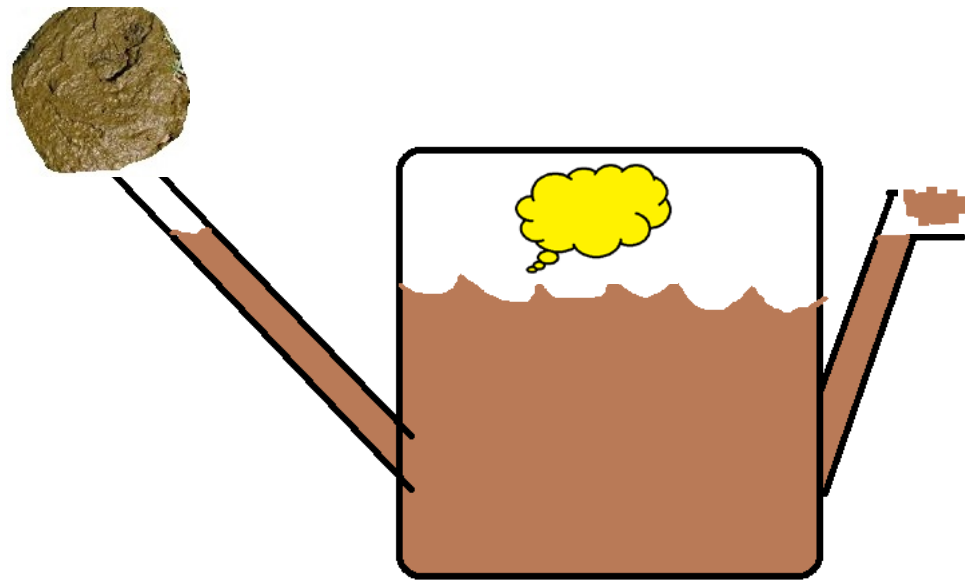
Conclusions

- Biogas and LPG stoves are clean
 - Near PM detection limit
 - PM Emissions from food
 - Plume cleaner than background air
- Simple biogas systems are appropriate
 - 15-20 year old systems working great
- Usage could increase with better maintenance
- Clean stoves do not meet all cooking needs
 - Outside stoves still needed

Biogas System Simulation Software



GobarCAD



You're welcome

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