



# **STRAW INNOVATIONS LTD.**



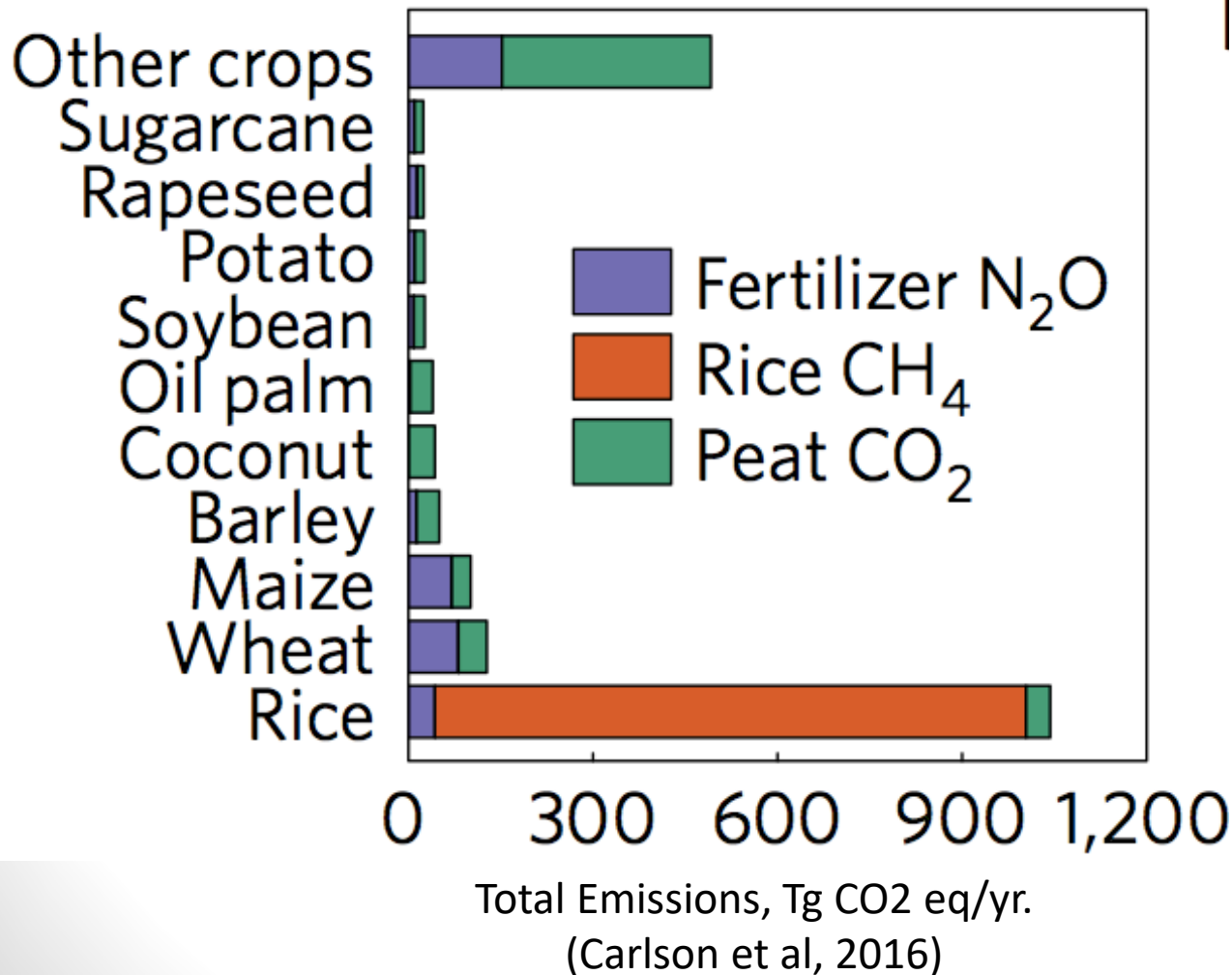
Craig Jamieson,  
LCEDN Conference, Loughborough University  
30<sup>th</sup> May, 2018

# The 'Nexus'

- **FOOD v  
FUEL v  
WATER**
- Increasing demand...
- ...whilst reducing GHG emissions!

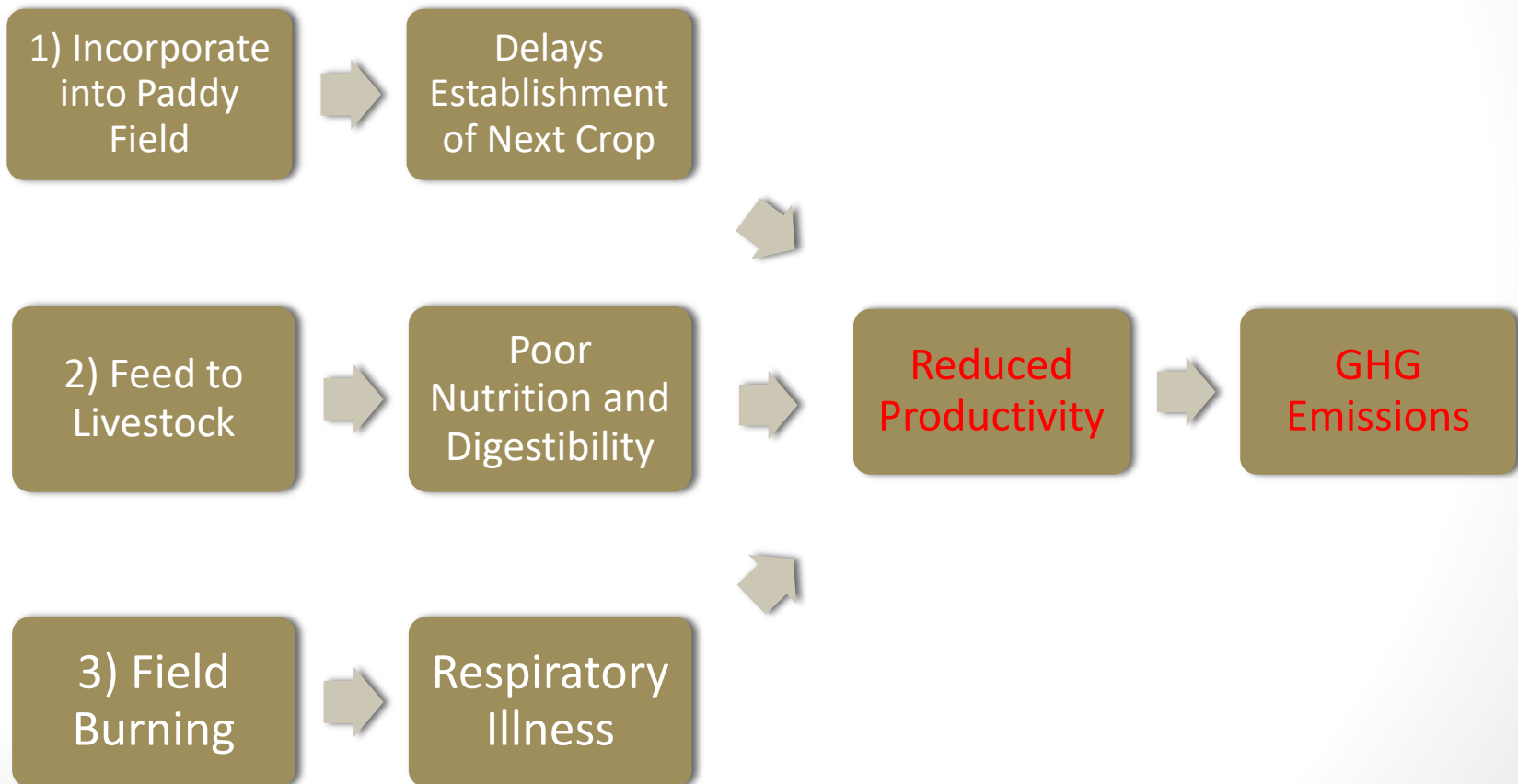


# Crop Emissions



- Rice = world's #1 food crop
- Demand due to increase by 70% in the next 30 yrs
- Responsible for 48% of **ALL** global crop emissions
  - Mostly from straw and roots decaying in flooded soils

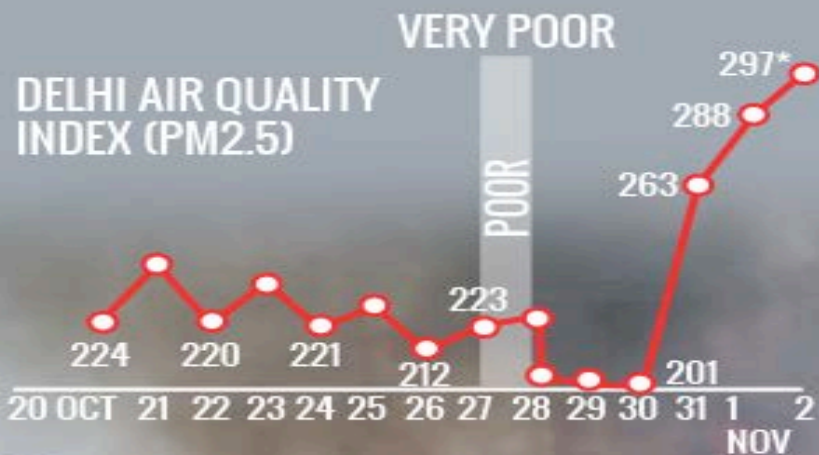
# Three Main Rice Straw Options



# Field Burning: 300,000,000 T/a

## DELHI CHOKES ON PUNJAB'S FIRES

The uncontrolled burning of paddy stubbles by Punjab's farmers has again put the health of residents in the National Capital Region at risk.



A NASA SATELLITE IMAGE DATED OCT 31 SHOWS 1000S OF 'FIRE-SPOTS' IN PUNJAB AND THE RESULTANT SMOKE OVER NORTHERN INDIA

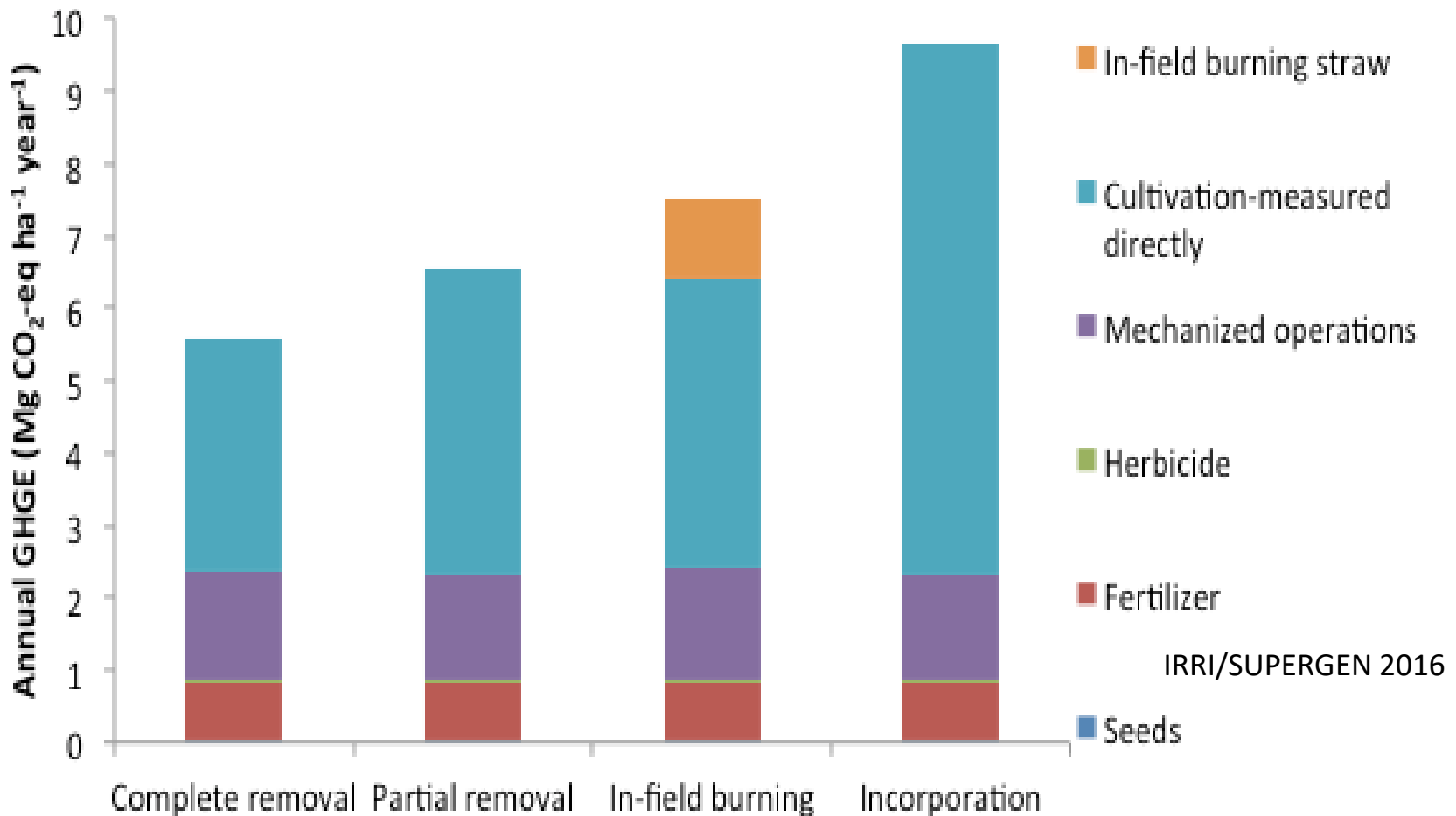


▶ NASA data shows that farm fires in Punjab, that began to register on satellite images around Oct 10, have increased in intensity since Oct 30

▶ Smog in Delhi from Oct 30 night, led to visibility dropping to 700-800m from 2km at IGI Airport

▶ Air quality has fallen sharply from Oct 31 onward and it now hovers close to a 'very poor' range level

# New Solution: Straw Removal...



## ...And Use for Bioenergy?

# Barriers to Rice Straw Bioenergy

1. Logistics

2. Fuel  
Properties

3. Business  
Challenges

4. Policy  
Failures



TECHNICAL

NON-TECHNICAL

“Rice Straw Energy Project” (2013-16)



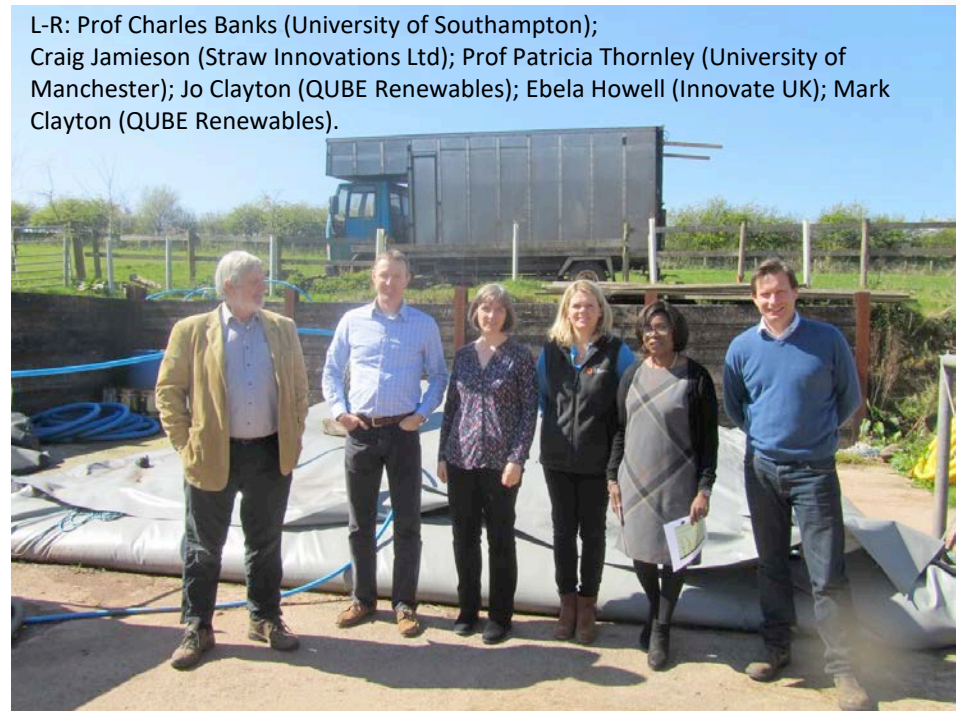
<http://ricestraw.irri.org/rice-straw-energy>



# Phase 2: Set up Pilot Plant

- “Rice Straw to Biogas (R2B) Project”
  - 3 years, 2017-2020
  - Village-scale biogas plant, Philippines

Innovate UK



L-R: Prof Charles Banks (University of Southampton); Craig Jamieson (Straw Innovations Ltd); Prof Patricia Thornley (University of Manchester); Jo Clayton (QUBE Renewables); Ebela Howell (Innovate UK); Mark Clayton (QUBE Renewables).



# 1. Straw Collection

- Innovative and efficient straw collection system



- Plans to integrate rice harvesting, threshing and straw collection into a single operation



## 2. Mushroom Production

- Straw used as growing medium
- 15 day cycle, single flush of edible mushrooms, which are processed into “mushroom steaks”
- Mushroom enzymes partially break down the straw ready for next step...

# 3. Anaerobic Digestion

- Specially designed “Dry AD” technology to overcome challenges of rice straw anaerobic digestion
- Abundant, renewable biogas fuel
  - Combined Heat and Power
  - Powering machinery
  - Smoke-free cooking



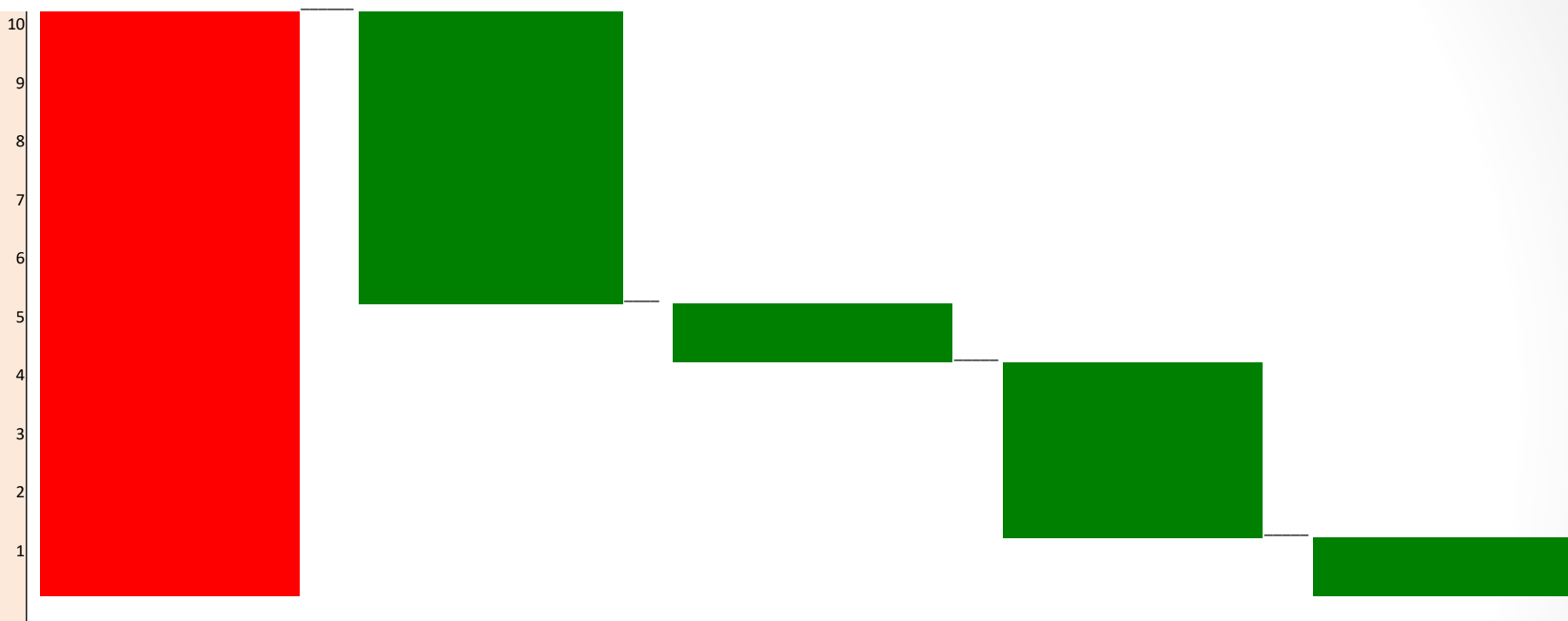
# 4. Recycle Nutrients



- Fertiliser / compost produced after anaerobic digestion
- Expected to increase rice yields by 10-15%
- Farmers only repay at harvest

# 5. Carbon Trading

EMISSIONS, TONNES CO<sub>2</sub> EQUIV / HA/YR



**Rice Cultivation**

**1) Straw Removal**  
from Paddy Field



**2) Mushroom**  
Production on Rice  
Straw



**3) Biogas** from  
AD of Spent  
Mushroom  
Compost



**4) Fertilizer** from  
Compost after  
Anaerobic  
Digestion



GHG SAVING INTERVENTIONS

# Our Vision

- **FOOD SECURITY**
  - increase rice yields
  - reduce losses
- **& CLIMATE ACTION**
  - neutralising emissions
- **& ENERGY SECURITY**
  - unlocking bioenergy potential of rice straw



