# Advanced biomass cooking

## A paradigm shift in meeting basic energy needs

**Christian Rakos**

# World Bioenergy Association

- Global umbrella organization, headquarter in Stockholm, Sweden
- More than 250 members – associations and industry
- Representing more than 50 countries worldwide
- **Activities include:** Global Bioenergy Statistics, Annual Reports, Factsheets, Magazines, mission trips and study visits, webinars etc.
- **Collaborations:** IRENA, IPCC, REN21, IEA, UNFCCC
- **Working group on Advanced Biomass Cooking**

# Net Zero by 2050

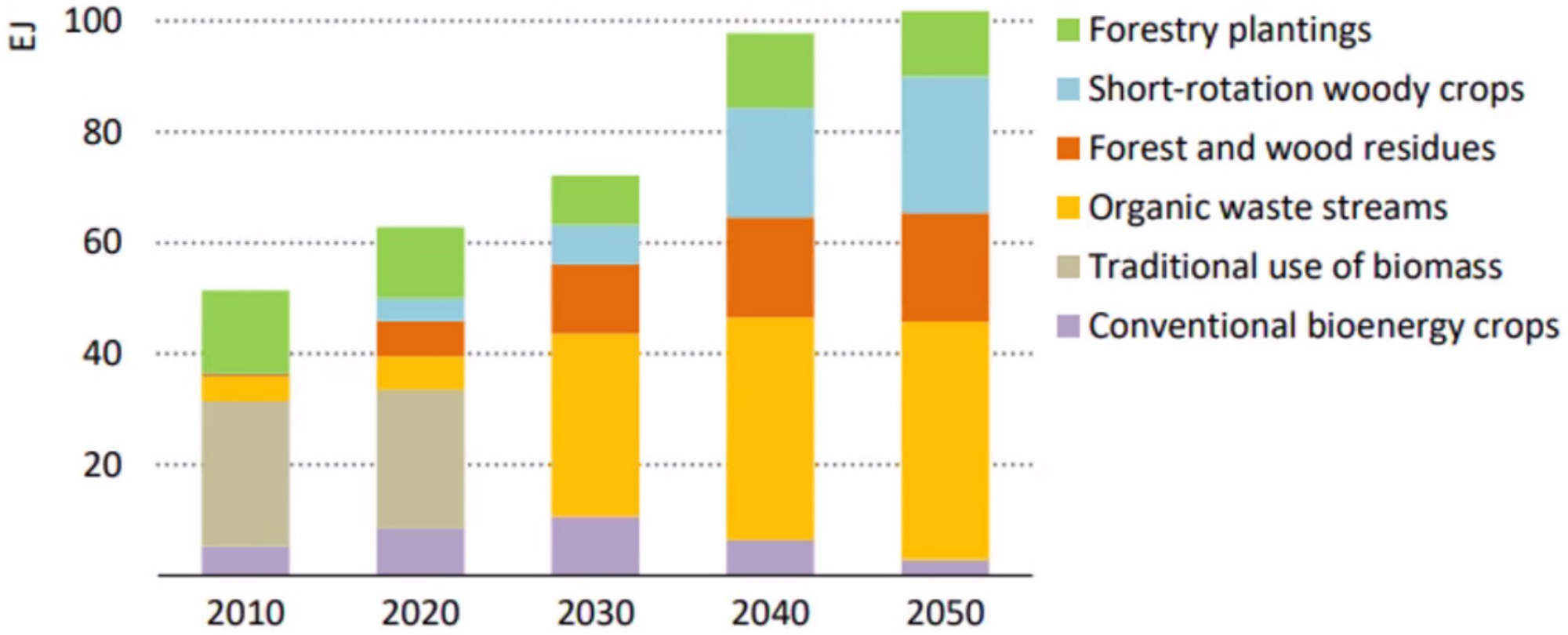
## A Roadmap for the Global Energy Sector

International Energy Agency

# Key statements of the IEA report regarding bioenergy

- 40% of current bioenergy use is traditional use for cooking
- This form of bioenergy use is unsustainable
- It should be replaced by modern forms of bioenergy use **by 2030**
- Modern forms of bioenergy use will play key role in a Net Zero World

**Figure 2.28 ▷ Global bioenergy supply by source in the NZE**






*Bioenergy use increases by around 60% between 2020 and 2050, while shifting away from conventional feedstocks and the traditional use of biomass*

# The size of the challenge

- 3 Billion people use traditional bioenergy for cooking
- 4 Million premature deaths are associated with air pollution from cooking on open fireplaces
- The efficiency of bioenergy use on open fire places is approx. 10-15%
- Charcoal use is even more wasteful due to the energy losses in charcoal production
- Urbanisation leads to intensified charcoal use
- Traditional cooking contributes significantly to deforestation

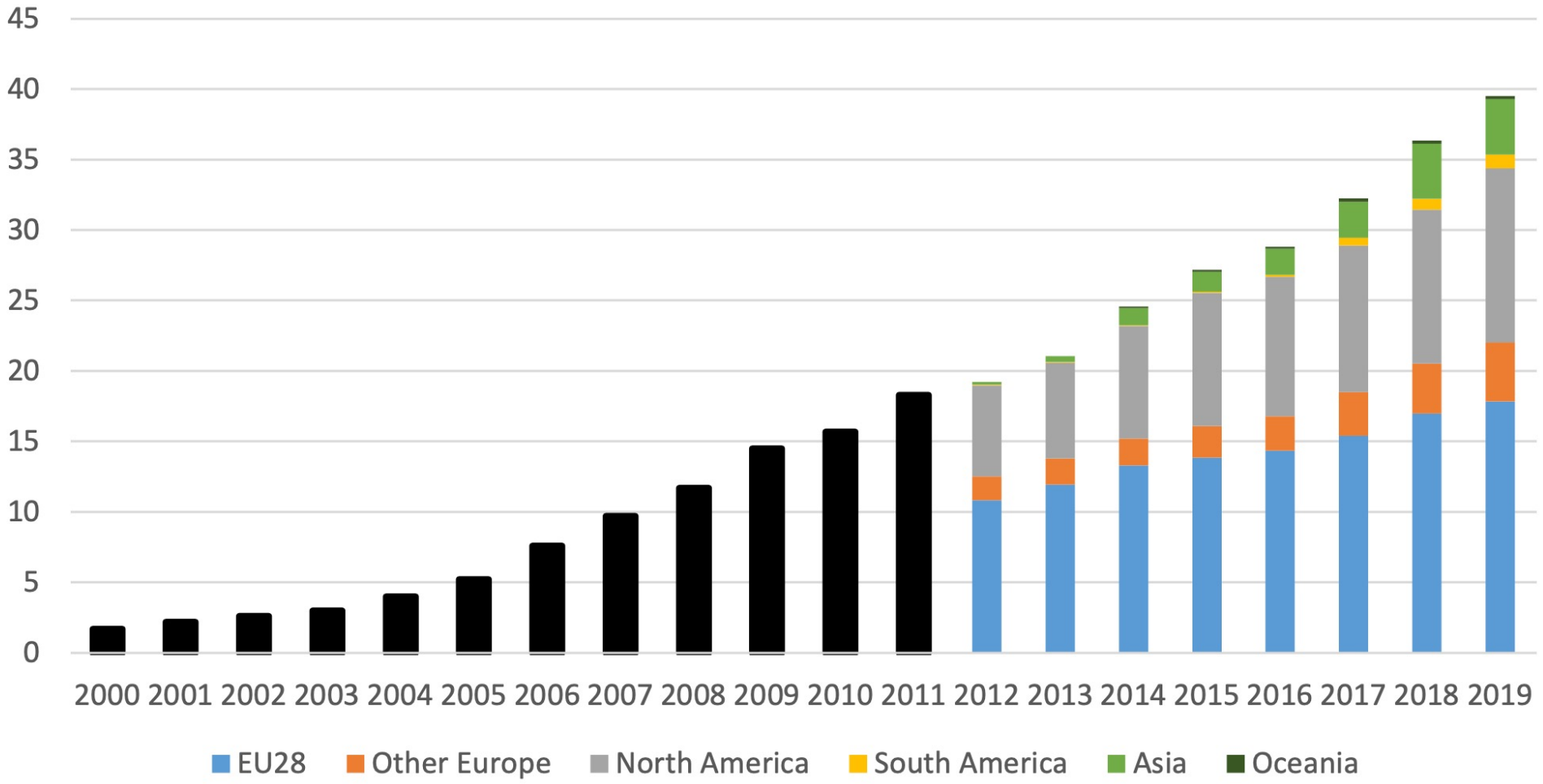
# Advanced Biomass Cooking
# =
# Radical innovation of cookstoves + upgrading of fuel

# Technologies for upgrading biomass

- Biogas production (fermentation)
- Ethanol production (fermentation +distillation)
- Pelletization – drying and densification

# Pellets – the fastest growing form of upgraded biomass

Figure 1 Evolution of global pellet production (million tonnes)



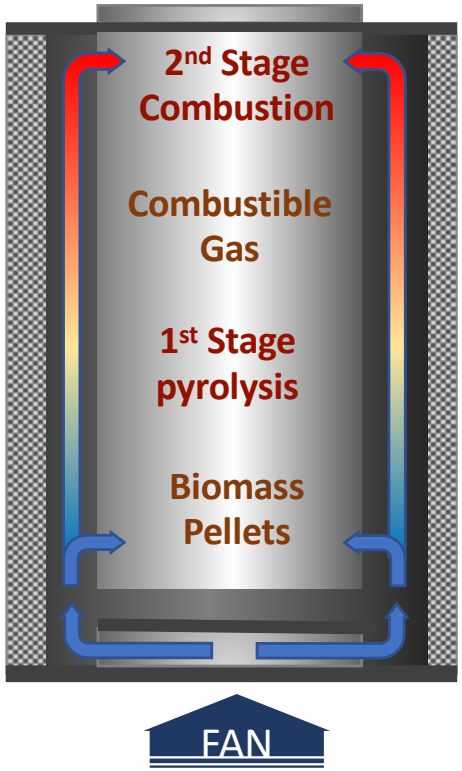

Source: Bioenergy Europe, Pellet statistics 2021

# Why is pellet production the most successful form of biomass upgradig?

- Economic
- Low energy demand for conversion!
- 2% of energy content needed for densification
- Heat for drying only needed for humid feedstocks
- Good fuel properties:
  - High energy density
  - Easy storage and transport
  - Clean combustion
  - Useful in small scale and large scale applications

# *Micro gasification – the key to clean cooking with biomass*

**Combustion process overview**



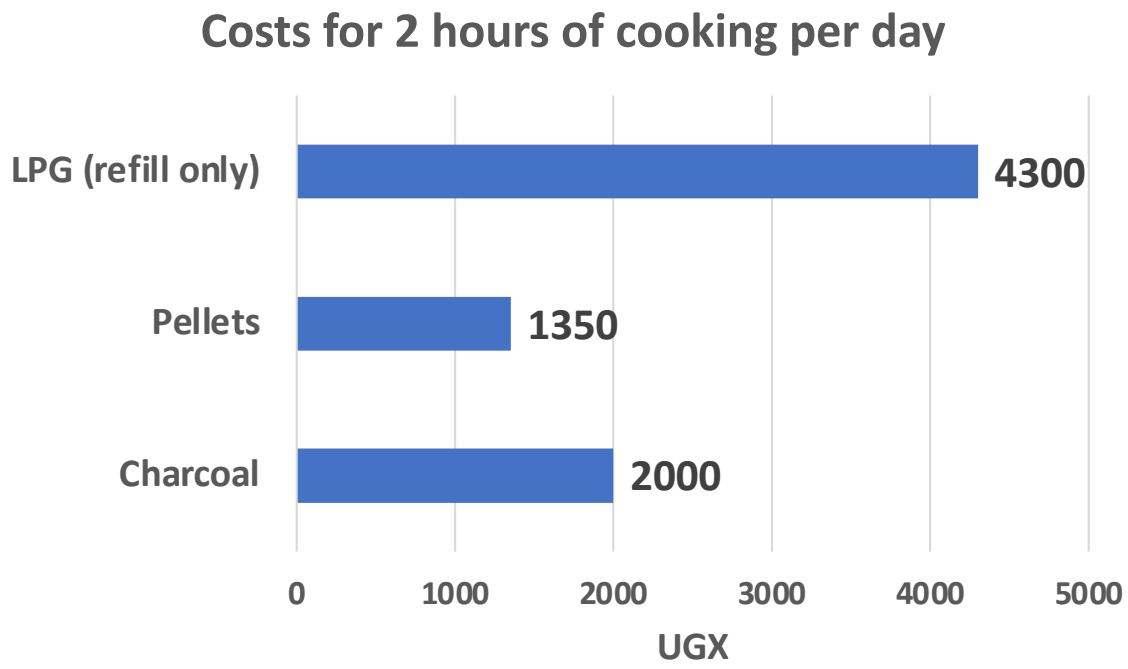

*Tom Reed first built a **Forced Air TLUD** stove design in the 1990's and called it a **Woodgas Stove***

## Micro-gasification is a simple thermo-chemical biomass combustion process that:

- ***Maximises the use of the energy stored in biomass fuels (approx. 40% efficiency)***
- ***Reduces smoke and carbon monoxide fumes by over 95%***
- ***Ideally suited to use any type of pelletized biomass***

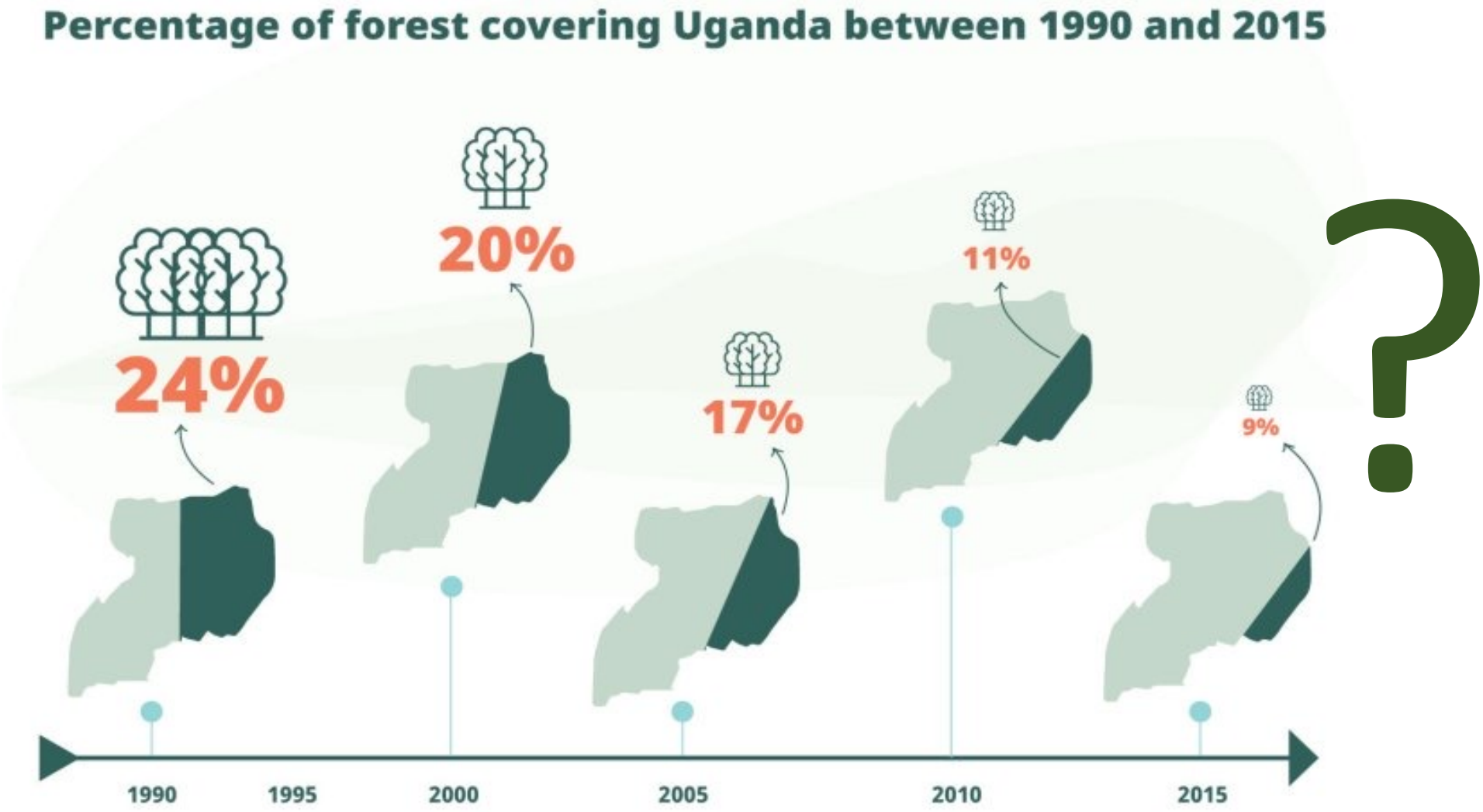
# The economics of pellet cooking

| Pellet need per household | |
|---|---|
| 0,9 | kg/h |
| 2 | h cooking time |
| 1,8 | kg/ day |
| 657 | kg/year |




Price base: Kampala
Uganda 2020
Assumed pellet price 200$/t

# The relevance of switching to pellets from agricultural residues



# Agricultural residues suitable for pellet production

- Rice Husks
- Straw
- Shells of nuts, peanuts, palm oil
- Bagasse of cane sugar production
- Sawdust
- Processing residues (coffe, plant fibres …)

# Main challenges of introducing pellet cooking

- Fuel supply: chicken and egg problem
- Costs of gasification cookstoves: 50-100$
- Cost of traditional charcoal stove: 5$
- Need to change habits

# Main opportunities for introducing pellet cooking

- Urbanisation: predominant use of purchased charcoal
- Increasing costs of charcoal due to ever scarcer wood ressources
- Local ban of charcoal use
- Possibility to cofinance stove costs by sales of pellets!
- Carbon credits: approx. 5t of CO2 reduction/year
- IOT technology for verification of stove use – create a new class of high quality CO2 certficates

https://www.worldbioenergy.org