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BIOENERGY

energy futures lab

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Outline

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#26

Techno – Economic Analysis of Palm Oil Waste as Bioenergy for Rural Electrification of Indonesia (Case Study: Belitung Island)

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Why it is important

Fossil Fuel Plants

Energy Poverty

Deforestation

Smog Production

Solid Waste

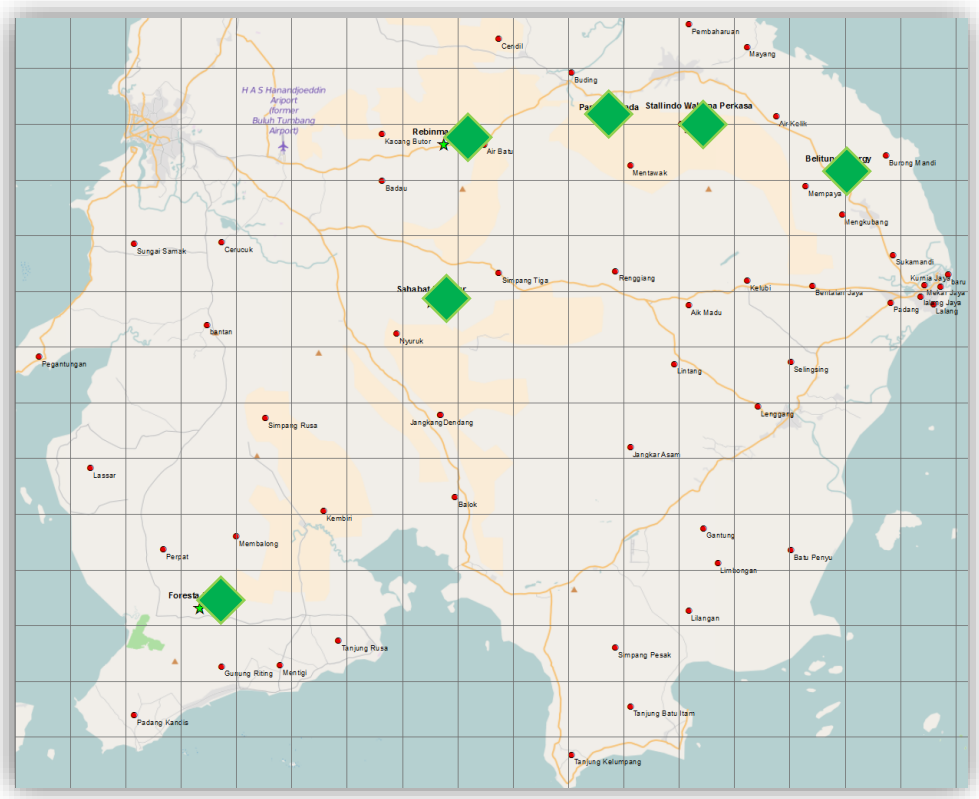
POME

Question ?

Economic Feasibility

Emission Reduction

Methodology



- Balance Supply & Demand
- 5 Palm oil Mills & 1 Biomass Plant
- 43 Villages 18.4 MW demand
- Minimize Investment Cost
- Plant Capacity & Location
- 4 different scenarios
  - Base case
  - Biogas focus
  - Conventional Combustion
  - CHP for biomass plant

Summary

All Schemes of utilization are feasible due to the profitable Feed in Tariff from government (Positive NPVs; Returns in < 15 years)

Limited to the owner of palm oil mill – high cost of solid waste

High Carbon Saving technology: POME – biogas plants

- high emission if left piled but has
- low power conversion, high utilization volume
- 60% carbon saving

Recommendation

- **Government Policy**
  - Reduce the solid waste price 40-80%
  - Subsidies for National Electricity Company (PLN) as the buyer of Feed in Tariff
- **POME – Biogas Plant**
  - Maximize to reduce higher emission
  - Combine with CHP plant for biomass for economic benefit

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#24

How Sustainable Land Use and Bioenergy Could Help Indonesia in Climate Change Mitigation?

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The Context

Intended Nationally Determined Contribution (INDC)

Reduce 29% GHG Emissions below its BaU level by 2030

Land use sectors and bioenergy

CHALLENGES ?

High population

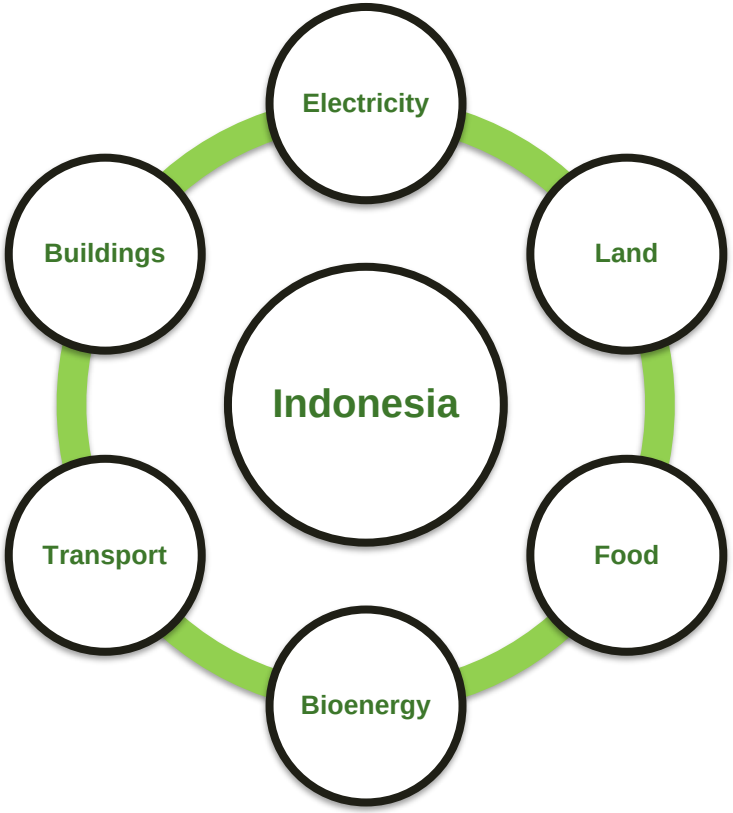
Increase oil palm land area

Deforestation

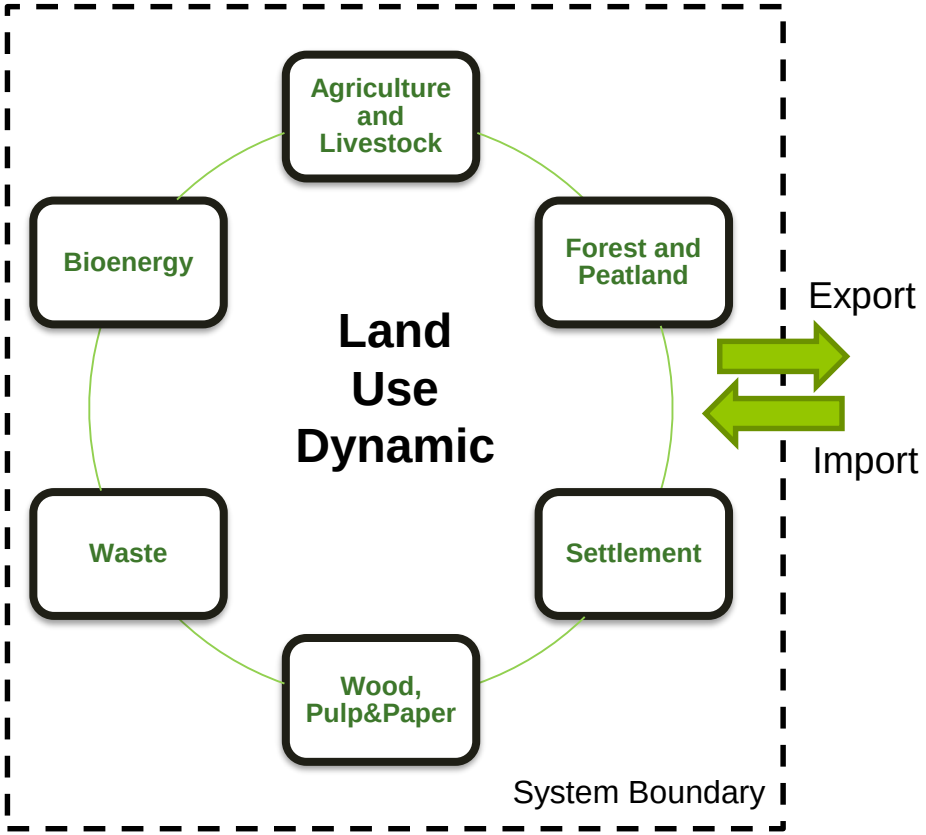
Peat fires

Methodology

Indonesia 2050 Pathway Calculator[1]



Indonesia Land Use Futures 2050



Results and Discussion

Simulation Results

Increase renewable energy

↓

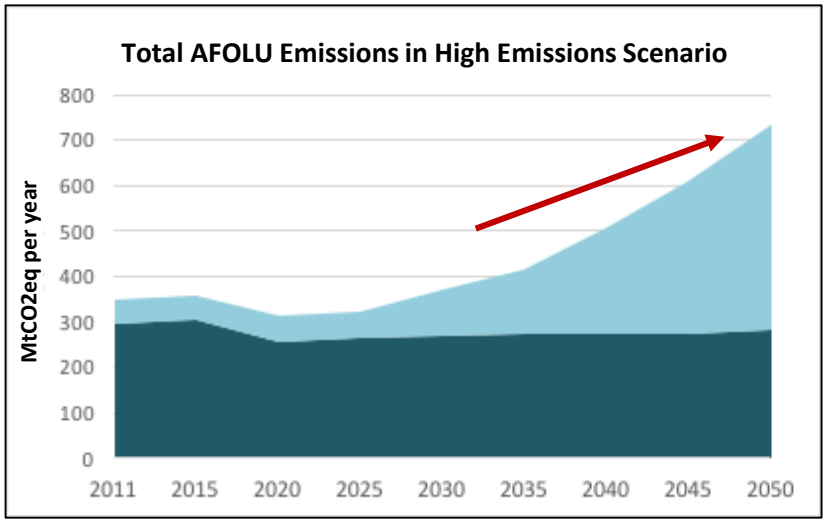
36% share in national energy mix by 2025 in INDC scenario

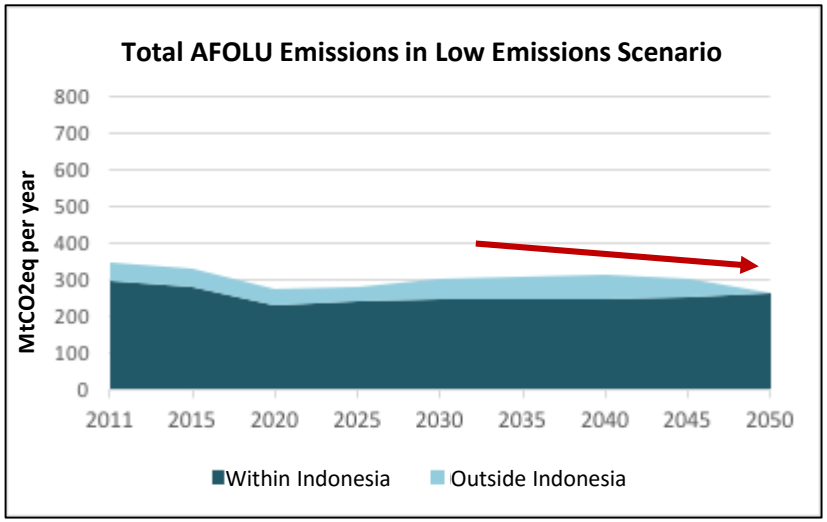
Land-use sector → **Critical sector** to tackle Indonesia's emissions

Agricultural and bioenergy expansion

↓

Potential emissions associated with **land use change** over native forest





Conclusion

SUSTAINABLE LAND USE POLICIES

*Sustainable land use policies will play **a major role** for climate change mitigation and food security*

*Substantial policy measures in **energy, agriculture, forest and peatland** would be needed*

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#25

Environmental Impact Assessment of Nipa-derived Bioethanol Production in Thailand

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Energy Issues in Thailand

Issues

- Heavily relying on energy import
- High carbon intensity

Plan

- Alternative energy development plan
- Increase biomass production from 1.3 ML/day in 2012 to 9 ML/day by 2021

Complication

- Need more feedstock for the increasing demand of ethanol

Why nipa palm?

High sugar content

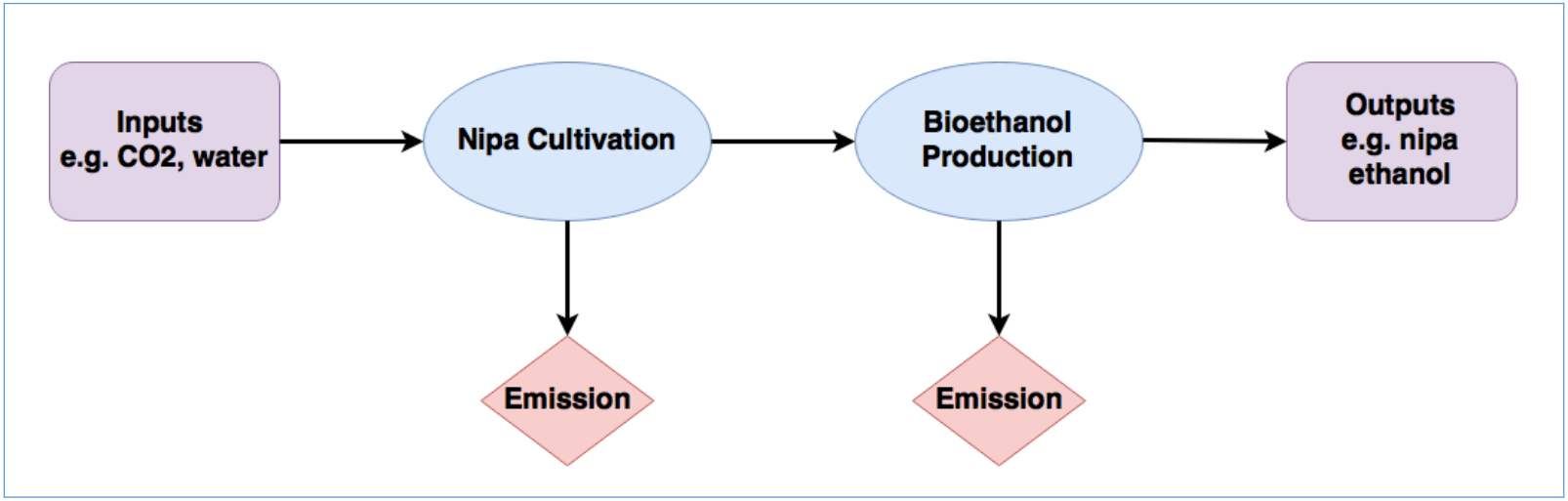
High ethanol yield

Less biomass waste

Simple unit operation

Grows well in Thailand

Method



- LCA of nipa-derived bioethanol production in SimaPro 8
- Calculate water footprint offline
- 3 comparisons:
  1. nipa-derived E85 VS. E10 VS. gasoline
  2. ethanol production in different regions of Thailand
  3. ethanol from nipa VS. maize VS. sugarcane

Results

Key points

- More sustainable than gasoline
- Less impacts than sugarcane and maize in most categories i.e. climate change, acidification and blue water footprint
- Consumes more green and grey water
- Need to improve water management and irrigation system

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#23

Introduction of a novel cooking stove in Malawi: the use of agricultural waste to avoid deforestation and environmental damage

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Malawi: Overview

- 40 USD/month in average
- Rural population in majority
- Agricultural country: Subsistence and export agriculture (macadamia industry 5th largest of the world)
- Traditional 3-stone fire for cooking
- Deforestation
- Climate change

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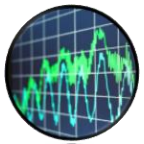
Solution: Cooking Stove

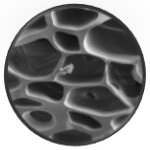
Methods & Results



- Efficiency tests: 57% less consumption than 3-stone fire

- Emission exposure test: 73% less exposure to Black Carbon

- Life cycle assessment: Overall contribution to global warming
  - Lower than traditional stoves
  - Higher than modern fuels (kerosene, LPG)



- Char characterisation: High surface area for nutrient adsorption
- Household surveys: Impact from the use of the improved stove

Cooking technology	3-stone Fire	Improved stove with wood	Improved stove with available waste	LPG stove
Annual expenses	26 USD	15 USD	10 USD	203 USD

Recommendations

- Education key for change from traditional cooking practices
- Developing programme to introduce the stoves financed with carbon credits
- High quality macadamia shell char for water purification as activated carbon

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#21

South African sugarcane supply chain optimisation for the production of bioenergy

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Sugarcane residues for bioenergy

- Energy challenges
- Great potential for sugarcane residues
- Gap between high level and local studies

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Supply chain modeling

FIELDS

SUGARCANE

COLLECTION SITES

SUGARCANE

SUGAR MILLS

BAGASSE

SUGAR

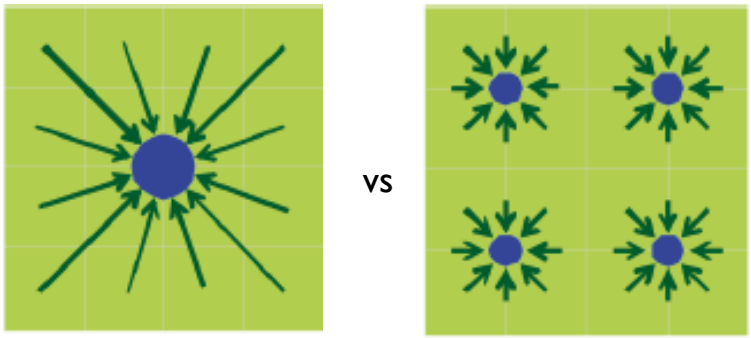
DISTRIBUTION CENTRES

ETHANOL
ELECTRICITY

BIOREFINERIES

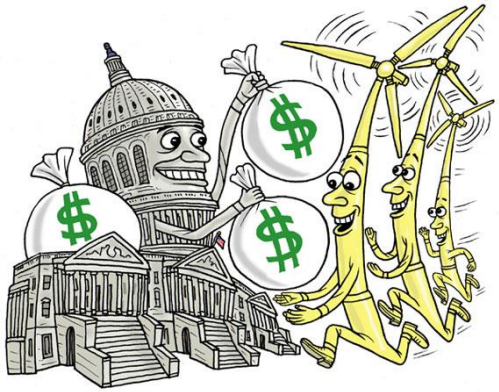
Optimisation outputs

STRATEGIC DECISIONS

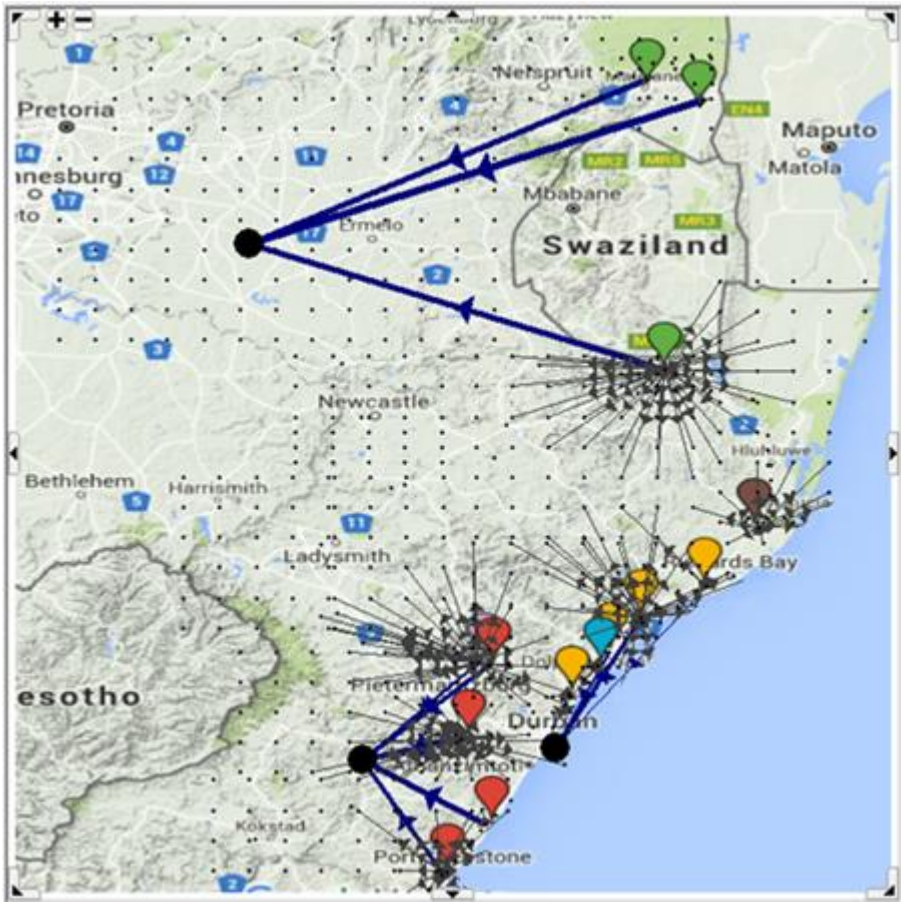


CENTRALISED vs DISTRIBUTED

SENSITIVITY ANALYSES



TACTICAL/OPERATIONAL DECISIONS



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#27

Municipal Solid Waste Fischer-Tropsch derived Aviation Biofuels : A Competitive and Investment Evaluation

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Alberto Carceles Peiro

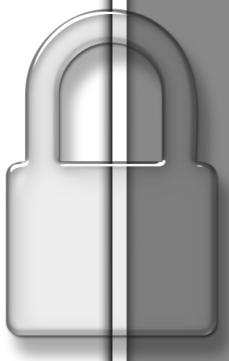
Context

26.3 million jobs

35% of world trade by value

and **0.5%** by Volume

Exchange of cultural knowledge and understanding



Aircrafts are powered by petroleum-based jet fuels

739 million tonnes CO_2

2% of total anthropogenic CO_2 emissions

6th

Fuel % Share in Operating Expenses

25%

Overview

The Progress

2 000 demonstration flights

Developed new or adapted existing production processes

BUT …

Actual uptake of aviation biofuels has been very modest

The Problem

- Limited availability of suitable feedstocks at an affordable and predictable price
- Lack of funding

Results

Conversion Pathway

- Municipal Solid Waste - Fischer-Tropsch
- Unutilized Waste = 89 million tonnes in Europe, 74% in Turkey, France, UK, Italy and Spain

Competitive Strategy

- Strong partnerships with suppliers
- Securing Funding: Policy plays a key role in reducing risk and uncertainty associated with the project

Investment Evaluation

- This project could be an attractive investment

Benefits:

Airlines: Manage Cost structure and Improve Corporate Social Responsibility efforts
Society: Reduction in carbon emissions ➔ Climate Change mitigation

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#22

The Energy in BECCS:
Is it possible to achieve the 2ºC target agreed in COP21?

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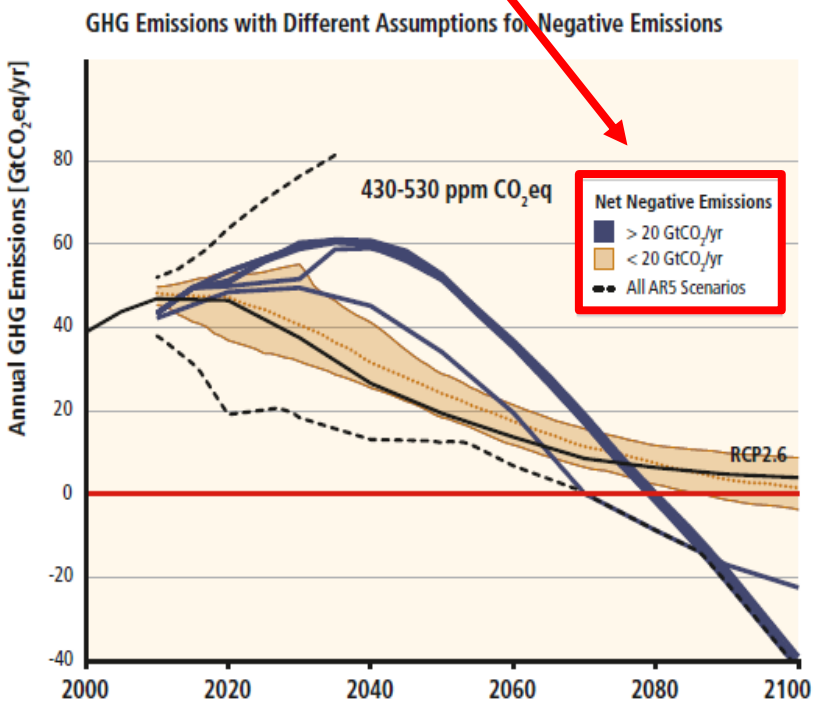
- ***Alberto Carceles Peiro***

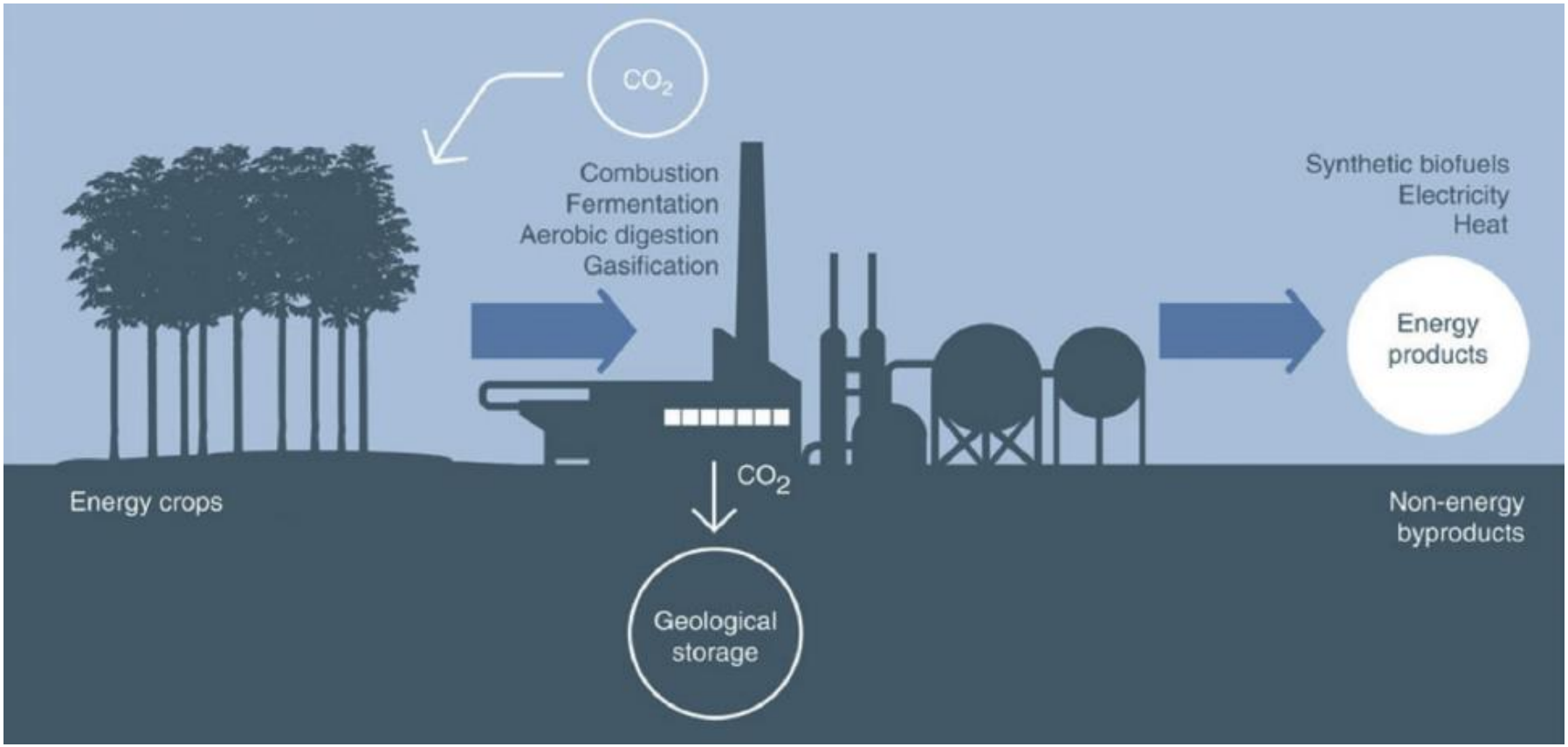
Paris Agreement and The IPCC

The 2ºC target is achieved in models mostly by removing billions of tons of CO_2 out of the atmosphere every year through something called **BECCS**



What is BECCS?

"Any combination of biomass combustion or processing with CO_2 capture and underground storage"



Theoretical Results

Of a life-cycle analysis of BECCS:

Some types of BECCS don't work

The ones that do, barely produce energy…

… And should need plantations of several times the size of India to remove the CO_2 assumed by the IPCC

Food poverty?

Population growth ?

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Questions?

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Sustainable Land-use Policy for Indonesia	Merdiani A Mokobombang	#24
Nipa-based Bioethanol in Thailand	Jean Ratanayanon	#25
Novel Cooking Stove in Malawi	Alan Goron	#23
Sugarcane for Bioenergy in South Africa	Remi Bucquet	#21
Aviation Biofuels	Adriana Soliz Miranda	#27
The Energy in BECCS	Alberto Cárceles Peiró	#22