



# Bioenergy sustainability assessment tool with GBEP indicators for IRENA Project Navigator

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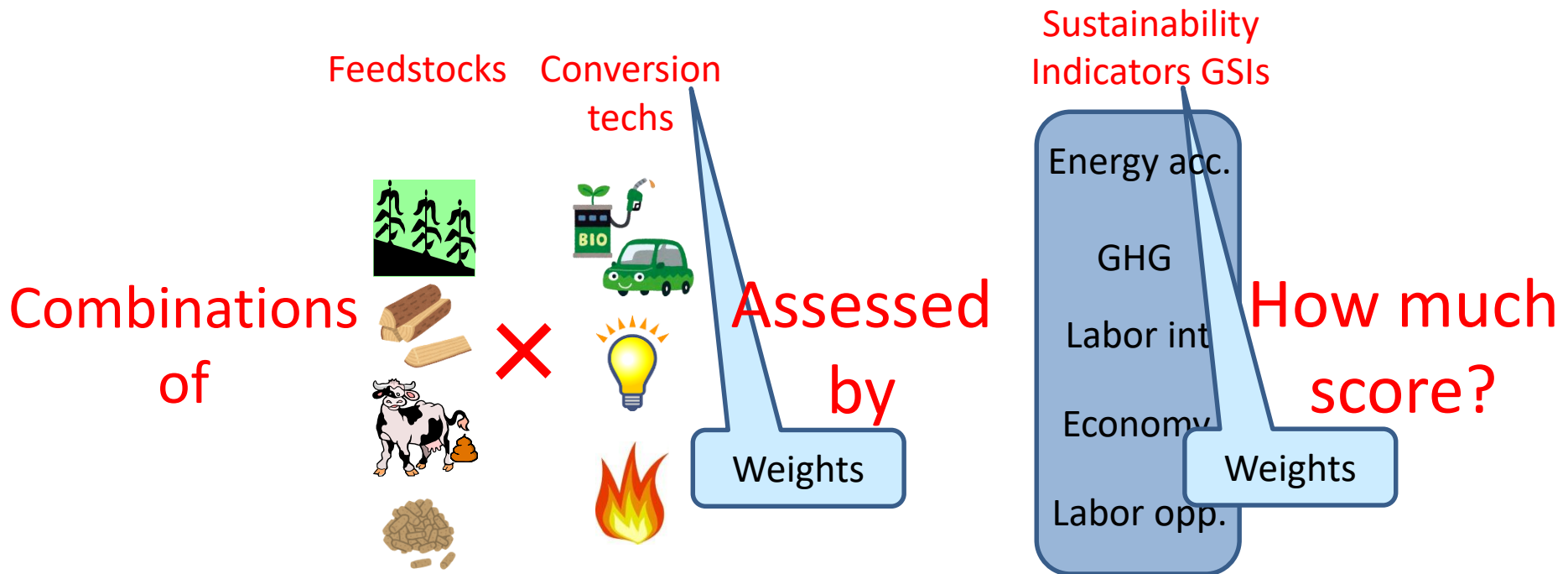
# Backgrounds

- Bioenergy has various stakeholders
  - Feedstock suppliers, Bioenergy processors, Distributers, Uses, Policymakers etc.
  - They see bioenergy from different points of view
- Policymakers have to make a decision to promote bioenergy policies
  - But it is difficult to reflect various opinions of different stakeholders

# Collaboration with IRENA and JIRCAS

## Out tool

- We have developed a Bioenergy sustainability assessment tool for sustainability of each combination of technologies and feedstocks based on the GBEP sustainability indicators for bioenergy (GSIs)



# Our works

- Applications to Ghanaian and Nigerian case
  - Experimental application of the model to estimate weights of each option
  - Modification of the model
    - The original model was modified considering the feasibility and data availability in Ghana and Nigeria

	Original	Ghanaian	Nigerian
Feedstock option	3 types	Not specified	Not specified
Technology option	7 options	4 options	4 options
Indicators	13 indicators	4 indicators	6 indicators
Working period	2015	2015-16	2017-18 (on going)

# Ghanaian case

- Four types of conversion technology which are popular or anticipated in Ghana
  - Power generation (direct combustion)
  - Power generation (gasification)
  - Liquid fuel
  - CHP
- Four indicators selected by IRENA are used our tool
  - Energy access
  - Labor opportunity
  - Economy (Cost)
  - GHG emission

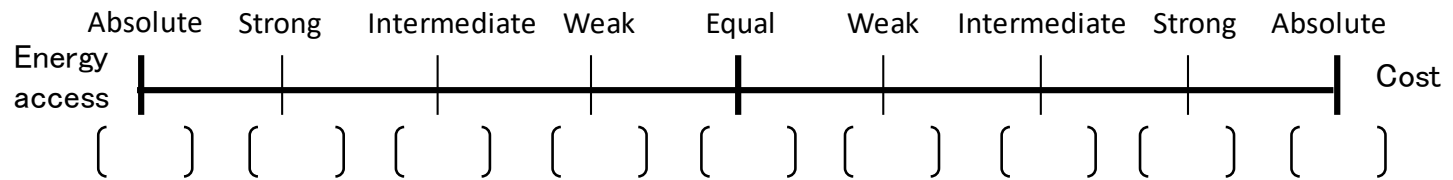
# Ghanaian case

## – Pairwise comparison by Analytical Hierarchy Process (AHP)

- A questionnaire survey for various stakeholders is needed
- Respondents were asked which is more important than another, for instance “energy access” and “cost”
- Respondents could select from nine levels of importance

2. Please select which of these two factors is more important, and how the factor is important than the other.

2-2 Of the two criteria “Energy access” and “Cost”, which is more important with respect to sustainable bioenergy and how much more?



# Ghanaian case

- Survey was conducted in winter 2015-16
- Questionnaires were delivered to various stakeholders of bioenergy in Ghana (65 in total)
  - national/local policymakers
  - plant owners
  - feedstock producers
  - financial sectors

Ecological zone	Brief characteristic and major commodity	Potential bioenergy feedstock	Representative town	Approximate number of interviewees
Coastal Savannah	Fishing, coastal	Maize stover	Accra	5
Rainforest	Forest, plantations, Cocoa	Timber waste, cassava peels, maize stover, oil palm waste	Takoradi	2
Deciduous forest	Forest, plantations, Cocoa	Timber waste, cassava peels, maize stover, oil palm waste	Kumasi	32
Transitional zone	Cocoa, cassava	Cassava peels, maize stover,	Sunyani	10
Guinea Savannah	Maize, Sorghum, Millet, Groundnut, Cowpea	Sorghum straw, millet straw, maize stover	Tamale	16
<b>Total</b>				<b>65</b>

# Ghanaian case (Results)

- Liquid fuel has the largest weight among four technology options

	EA	LO	ECO	GHG		Indicator weight		Total weight	
PGD	0.40	0.24	0.24	0.16	X	EA	0.44	PGD	0.30
PGG	0.16	0.21	0.21	0.29		LO	0.28	PGG	0.20
LF	0.29	0.35	0.35	0.37		ECO	0.19	LF	0.33
CHP	0.14	0.20	0.20	0.18		GHG	0.10	CHP	0.17

- Advantages:
  - Reflect the opinions of various stakeholders
  - Simple and easy to calculate
- Limitations:
  - As the number of indicators and tech options increase, more comparisons should be made that make questionnaires more complicated and burden for respondents



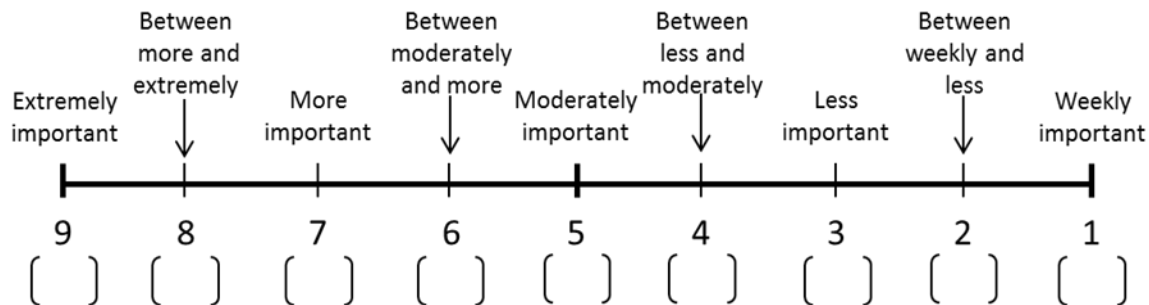
# Nigerian case

- Four types of conversion technology which are popular or anticipated there
  - Bioethanol
  - Biogas
  - Improved cook stove
  - CHP
- Six indicators selected from GSIs by local consultants
  - Water use and efficiency
  - Land use and the change
  - Price and supply of food
  - Jobs
  - Productivity
  - Infrastructure and logistics

# Nigerian case

- Absolute valuation of contribution to sustainability
  - Respondents were asked how much, for instance, bioethanol significantly contributes to water use efficiency

5-1 From your point of view, how much significantly **Bioethanol (BIE)** will contribute to water use and efficiency (WU) of the bioenergy sustainability indicator?



- Survey is currently underway, and results and the analysis will be obtained by March

# Can be a tool to ensure stakeholders' priority on sustainability for IRENA Project Navigator

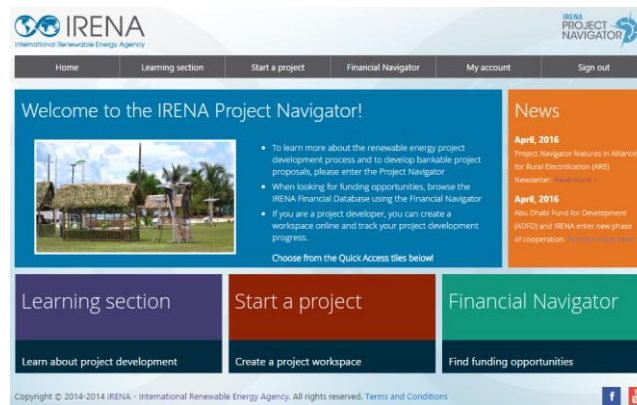
- Our tool
  - Can quantitatively assess the sustainability of bioenergy options
  - Can reflect what various stakeholders think of each criteria of sustainability as weights of the indicators
  - Can be incorporated into the [IRENA Project Navigator](#)

# IRENA Project Navigator

- IRENA's Project Navigator is a comprehensive platform giving project developers the tools – at no cost – to create robust, bankable renewable energy project proposals, thus accelerating the deployment of renewable energy worldwide



IRENA Project Navigator users worldwide



Find us at [www.irena.org/navigator](http://www.irena.org/navigator)

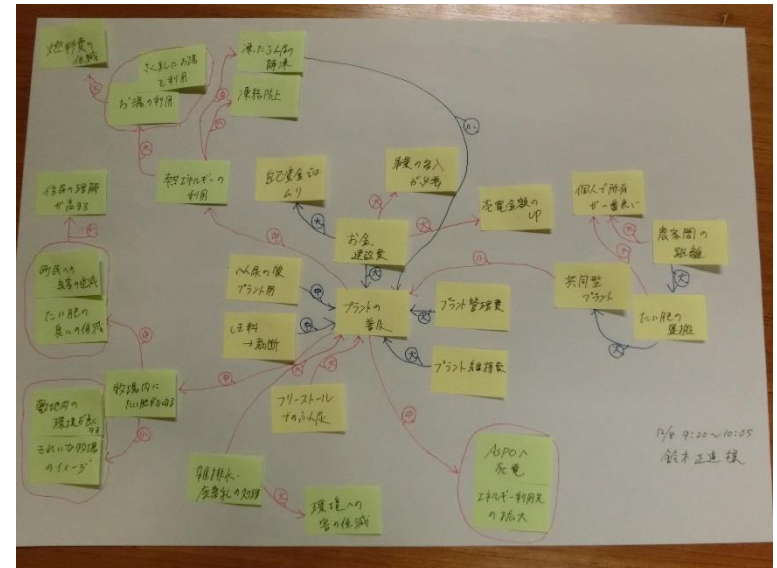
For Bioenergy  
(More version is coming..)



Project Navigator Module  
for Heat and Power from  
Solid Biofuels

# Further studies

- Developing a new tools
  - A method to directly reflect opinions of stakeholders





Thank you very much  
for your attention!

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