Biofueling Rural Development: Making the case for linking Bioethanol Production to Rural Revitalization

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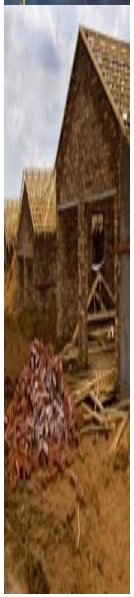
Household sector energy use in Nigeria

•Nigeria's household energy sector is the largest energy consuming sector of the economy, mostly for cooking and heating, with fuel wood being the major source of cooking and heating. Forests and woodlands are estimated at 9.6 million hectares, representing 16 per cent the total land cover

•This amount supplies two-thirds of the total energy needs of Nigeria's household sector put at an equivalent of 263kg of coal per household per annum. The energy requirement is met by biomass, which together with fuel wood account for over 60 per cent of the total energy consumption.



Household sector energy use in Nigeria

In the rural communities, an estimated 65 million people made up of 9 million families cook with fuel-wood, while 25 million people made up of 3.5 million families cook with kerosene. In the urban area in Nigeria, an estimated 30 million people comprising 4 million families cook with kerosene stoves

Approximately, 8 million kerosene stoves are used in Nigeria at the moment. At one litre per family per day, an estimated 8 million litres of kerosene are consumed in Nigeria daily for household cooking alone.

Nigerian National Petroleum Corporation (NNPC) figures estimate that a total of 18 million litres of kerosene are used in Nigeria daily by all sectors. This estimate translates to two litres per family per day totalling 16 million litres, while the remainder of two million litres is used in industrial applications.

Household sector energy use in Nigeria

The use of renewable energy and specifically, biofuels (if produced in an ecological, social and economically sustainable manner) could help mitigate the health related problems associated with the use of wood fuel, reduce death and mortality rate, reduce the drudgery in women as fetching of wood fuel is gender related, improve the quality of life and the standard of living of the population through effective rural transformation.

The World Health Organization (WHO) in 2007 put total deaths from the use of solid fuels in Nigeria at a frightening 79,000 so far; the highest reported incidence in Africa (WHO, 2007).

Biofuels

•In Africa, as around the world, energy issues have moved higher in the development agenda of policy-makers. This was mostly prompted by the recognition that without energy most development objectives, including the Millennium Development Goals, cannot be met

•Biofuels have emerged as one of the most promising new sectors for rural Africa.

•Biofuels are gas or liquid fuel derived from biomass

•A CLD is a tool that is used in systems analysis approach to understand causes and effects, to describe reality through causalities between variables and how they form a dynamic circular influence. It is used to observe the system through feedbacks rather than linearly and observes repeated patterns that may be used to predict the behaviour in the problem

Economic, environmental and social benefits of bio-ethanol

(Amigun and von Blottnitz, 2010)

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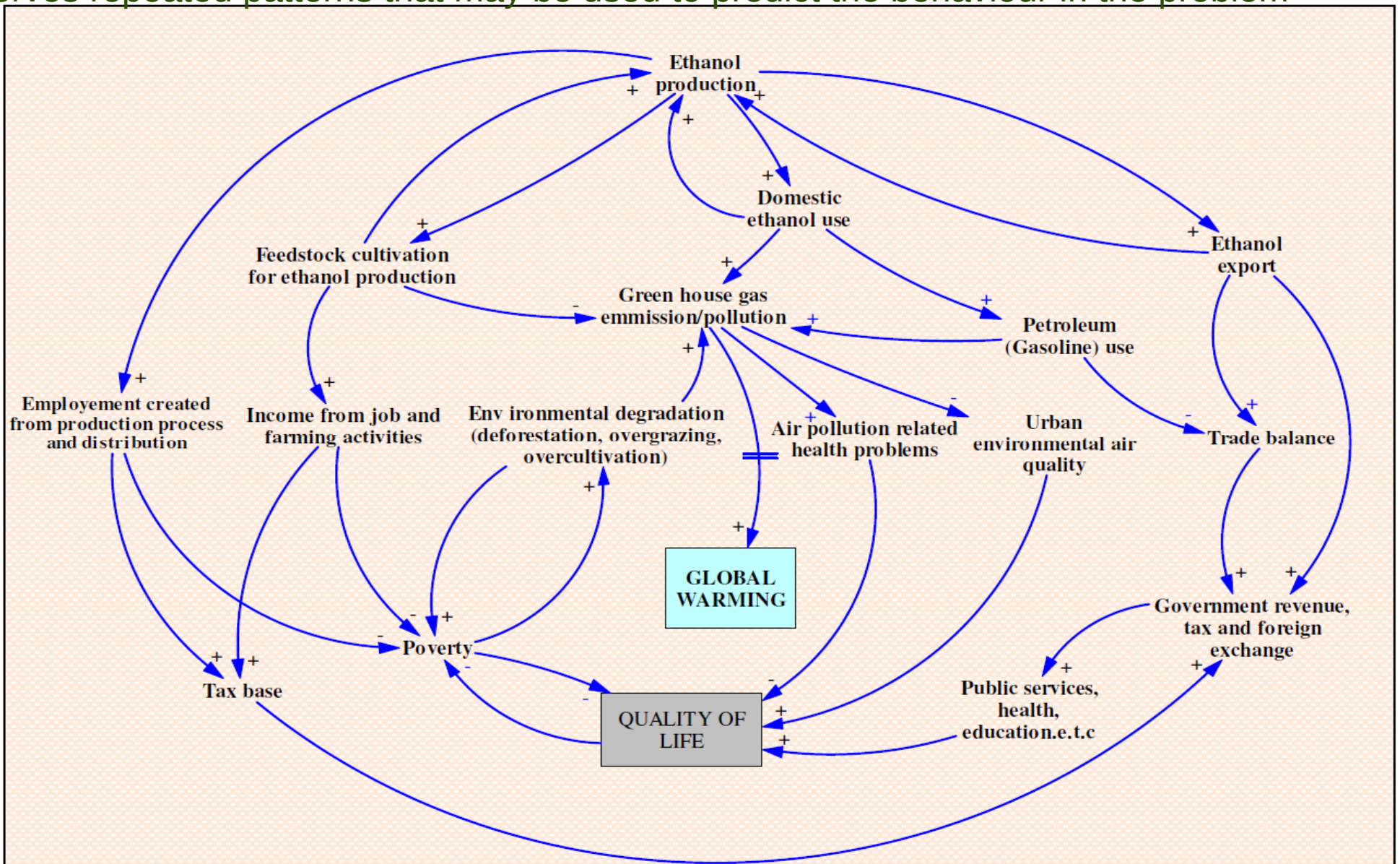


SOCIO-ECONOMIC AND ENVIRONMENTAL BENEFITS OF CONVERTING WASTE TO ENERGY

Converting wastes into a clean, renewable energy has profound social and environmental benefits.

- It will help mitigate our dependence on imported oil,
- lower the price of gasoline,
- save foreign exchange,
- generate heat and electricity which is crucial to sustainable development,
- reduce the amount of waste land-filled,
- lower greenhouse gases and
- create a new industry of jobs and economic growth

Biofuels in Nigeria

In Nigeria, due to rural, agricultural development and environmental improvement reasons (improving the quality of cooking and transport fossil-based fuels), the government is developing biomass ethanol as one of its transportation fuels.

The Nigerian National Policy on Biofuels, (2007) seeks to establish a thriving fuel ethanol industry utilizing agricultural products as means of improving the quality of cooking and transport fossil-based fuels. It hopes to prepare regulations for sale and use, and guarantee off-take under contractual terms. It aims to achieve job creation, rural and agricultural development and technology acquisition and transfer; attract foreign investment and streamline roles of Federal, state and local governments in biofuels development.

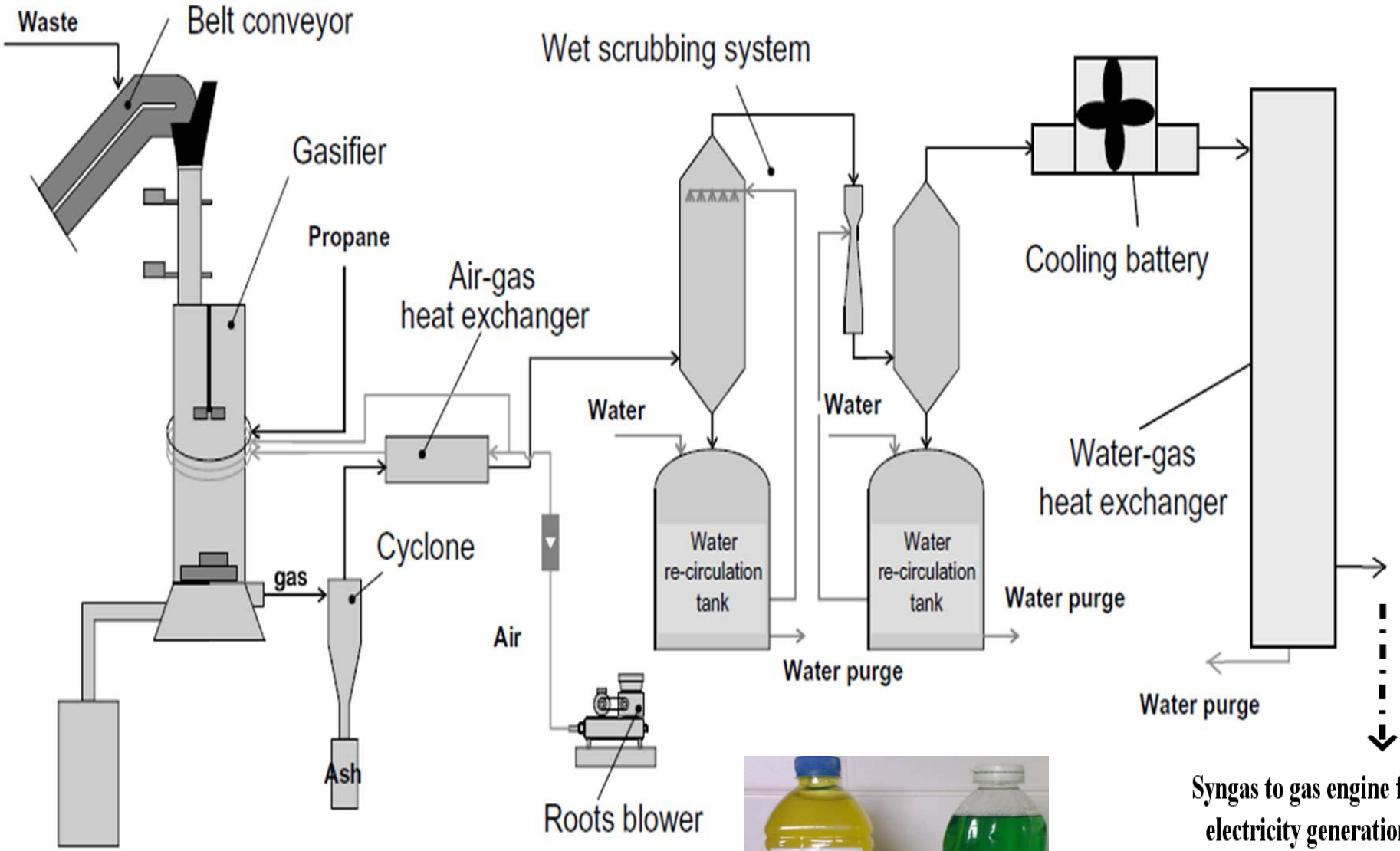
Biofuels

•Biofuel production in developing countries including Nigeria and its potential is a complex and inherently conflict-ridden issue, which has given rise to much debate over recent years.

•Some parties see mainly the opportunities for improved markets for agricultural production and rural development coupled with enhancing a low-carbon development.

• Others fear competition for land and food production with no real gain – or even loss - for local populations or environmental condition. Even the carbon footprint of biofuel production is variable, depending for instance on the selected production systems and method

LAYOUT OF THE WASTE TO BIOETHANOL PLANT



Ethanol/Ethanol gel fuel

(ethanol conversion to ethanol gel fuel)-
Paraffin replacement

Syngas to gas engine for electricity generation

Syngas to ethanol production through bacterial conversion

NATIONAL BIOTECHNOLOGY DEVELOPMENT AGENCY
NABDA

NON BIODEGRADABLE WASTE TO ENERGY

The research approach to achieving the conversion of non biodegradable to energy involves a gasification/bio-catalytic process. The process involves three main steps:

Pyrolysis/Gasification. Thermal gasification of the feedstock mixtures using appropriate gasifier (reactor) in a reducing, oxygen-starved atmosphere “cracks” the materials and reforms them into simple CO, CO_2 and H_2 gases (syngas/synthesis gas). Before the syngas/synthesis is further introduced to the bacteria in a fermentation tank in the next stage, it is expedient to cool the synthesis gases to approximately 97°F- a process that generates an enormous amount of **waste heat** that can be used to create high temperature steam to drive electric turbines for **electricity generation**. Generating its own power from production operations, of course, cuts the operating cost and ultimate the unit cost of the fuel.

Fermentation. The acetogenic *Clostridium ljungdahlii* convert the carbon monoxide into ethanol.

Distillation. Ethanol is separated from hydrogen and water.



THE NEED FOR LOCAL PARTICIPATION

The argument for involving local people in (bioenergy) technology implementation is backed by evidence of tangible and non-tangible benefits that have accrued to participating communities:

✓Enhanced income resulting from application of appropriate technology in rural enterprise.
✓More efficient use of project resources, particularly time and capital.
✓More effective delivery of rural development programmes.
✓Increase in local capabilities and user confidence with developed technologies, as well as a sense of responsibility for individual and community systems.
✓More widespread adoption of the technologies and improved likelihood of long-term sustainability.

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METHODOLOGY EMPLOYED

The project considers a consultative approach to biofuel project development, namely local decision making, community participation and grassroots mobilisation, rather than a market opportunity approach.

The focus is on the public opinion of a proposed bioethanol plant (to be used primarily in clean cook-stoves and as transport fuel) and associated supply chain development in Ogbomoso, Oyo state of Nigeria.

The results are therefore deemed useful for policy makers to understand why communities may object to bioenergy projects, and to assist the developers of such projects to avoid delays and non-acceptance that can be associated with adverse local opinions and increased adoption of renewable energy technology



THE NEED FOR LOCAL PARTICIPATION

The three methods employed in the social acceptance survey include:

- ✓a questionnaire (comprising the qualitative and quantitative data collection),
- ✓a series of semi-structured interviews and
- ✓a focus group discussion (qualitative data collection only).

These combinations of approaches are used to gauge the attitude of the local community to the proposed bioethanol facility through data triangulation which is the use of more than one approach to the investigation of a research question in order to enhance confidence in the ensuing findings.

Statistical analysis were also employed for data analysis and interpretation. Generally, the survey methodology bring together insights from cognitive and social psychology, sociology and statistics to explain how human behaviour and survey design decisions interact to produce data of varying quality

PRELIMINARY FINDINGS

Findings revealed that research into public attitudes towards, and the causes of conflict over energy development projects of many different types shows that attitudes can be highly variable, dynamic and sometimes contradictory. They may be rooted in deep-seated cultural and ideological identities and formed from a variable and interacting mix of influences and sources of information.

Generalising between places and across time can thus be misleading and nearly impossible. Nevertheless, local people tend to use rights and moral-based arguments to oppose developments.

- The development is involuntarily imposed on the publics' locality;
- The technology is unfamiliar;
- The public has no decision making power; or
- The development is for corporate profit rather than local benefit.

PRELIMINARY FINDINGS; Some of the specific concerns

- ✓General concern of water pollution and environmental concern posing further health risk
- ✓Lack of confidence about the credibility of the developer due to past experiences
- ✓In-migration of people into the community (mixed reaction)
- ✓Food security: the use of cassava to produce bioethanol
- ✓Land issue

Investment in rural energy markets: strategies towards successful implementation

Energy choices are driven by economics, technology superiority, local resources availability, social values/custom, cultural preferences, politics, policy regimes and societal needs/demands. Investors should recognise that each community has its own set of peculiarities and needs, specific to that community and depending on the prevailing local environment.

There is therefore need for investors to carry out a detailed and participatory resource evaluation need of rural communities and municipalities before commencing action on renewable energy systems using existing resources.

Investment in rural energy markets: strategies towards successful implementation

Need assessment, is the first step towards building a successful rural energy programme. The need assessment should be backed up with a detailed energy situation report on the current energy scenario and related parameters. This should include both secondary and primary information. Inputs related to energy sources should include information such as availability of biomass resources –fuelwood, crop residues, animal dung, perennial water flows, solar radiation, wind patterns, e.t.c.

The current energy flow in the community-this section should also include the energy use in the community, i.e., demand, should be tabulated/listed by sources, by different sectors. Community demography , income , infrastructure and willingness to pay for the services

Investment in rural energy markets: strategies towards successful implementation

Appropriate technology selection: It is important to include the fact that decentralised systems are technology-neutral. There is no single "off-the-shelf" solution to cater to all rural energy requirements. Therefore, one has to find the appropriate technology for each location. Technology choices are guided by resources available at the location.

Competition of biomass energy systems with the present use of biomass resources (such as agricultural residues) in applications such as animal feed and bedding, soil maintenance and fertilisation, and construction materials. These may be of higher priority to rural populations, as alternatives might not exist.

Investment in rural energy markets: strategies towards successful implementation

Community participation: The local community needs to be carried along at each stage of the development exercise. Community participation pays long-term dividends for the project promoters.

Delivery mechanism: The delivery mechanism employed to provide energy services is perhaps one of the most critical factors affecting the success of an intervention. This section should highlight the partnerships and stakeholders involved in an energy intervention for remote areas: government, equipment manufacturers, communities, market intermediary, financial institution e.t.c. and their responsibilities .

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Community perspectives on the introduction of biodiesel production in the Eastern Cape Province of South Africa

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ABSTRACT

This paper presents the outcomes of a questionnaire survey to ascertain the perspectives of local communities on the proposal to construct a large-scale biodiesel production facility in the Eastern Cape Province of South Africa, with feedstock supply to the production facility from the former communal homelands of the Province. A total of 303 questionnaires were administered through interactions with the communities that are expected to be a part of the feedstock production supply chain by visiting households and having in-depth interviews, and through a focus group discussion. Opinions were found to be overwhelmingly against the proposed biodiesel production supply chain. The concerns of local people varied, but the major issues were land availability as this is regarded as their identity; infrastructure development; associated pollution (air and water) posing serious health risk; doubts about the credibility of the developers; food security; and the distortion of the social fabric of the local communities. In general, local people felt that they were excluded from the project development and were asked to accept industrial scale development that will further lead to the impoverishment of the communities. The results also highlighted how large-scale plants may be affected by the local dynamics of perceptions; the willingness to partake in the supply chain was informed by personal, social and institutional factors and beliefs, as well as internal conflicts, due to perceived environmental, social and ecological risks, that were aggravated by miscommunication and the lack of understanding. The paper is deemed useful for policy makers to understand why communities may object to relatively large bioenergy projects, and to assist the developers of such projects to avoid delays and refusal of planning consent that can be associated with adverse local opinions.

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