SOCIALLY INCLUSIVE SUSTAINABLE DEVELOPMENT IN A CLIMATE STRESSED NORTHERN NIGERIA: A CASE STUDY OF JIGAWA STATE

By

Aliyu Sanusi, PhD, Economist **Ahmadu Bello University, Zaria**

Soji Apampa, development policy analyst, Director Integrity Organisation

Ayo Sotinrin, Environmental Policy Advisor, Special Assistant Environment to the Honourable Minister of State, FCT

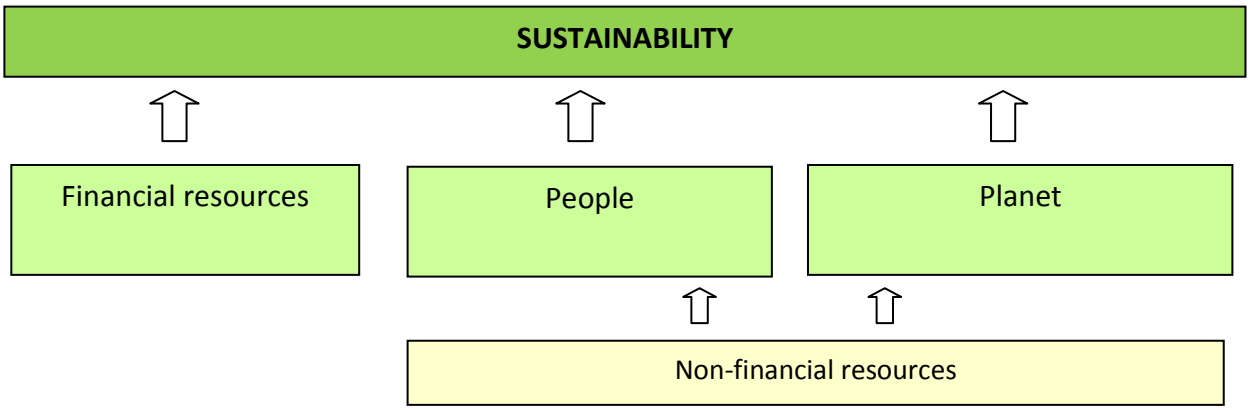
With support from Chibueze Emenike, Project Manager, Heinrich Böll Foundation Nigeria

July 2013

Executive Summary

This study provides examples of how Jigawa State could create employment opportunities, increase agricultural yields and protect the environment for future generations by employing greener development options. Based on an analysis of Jigawa State's 2010 budget, the study calculated examples of practical policy options. Thus, the study shows that by investing in green and sustainable technology, more people will benefit and agricultural yields will increase. The comparison of diesel powered irrigation pumps versus solar pumps reveals a potential saving of 12 billion Naira over a period of 10 years. The comparison of chemical fertiliser vs organic fertiliser reveals potential savings of more than 8 billion Naira for the same period. By introducing small-scale biogas systems the State's development goal of providing at least 30% of households with electricity could be achieved ahead of the deadline of 2020.

This study wants to encourage policy makers, civil society and development thinkers to adopt a different perspective that would take into account the following framework:



The study argues that in order to address the underlying causes of poverty and to chart a way forward for Jigawa State's sustained growth, the underlying climate factors (that have led to alarming levels of desertification) have to be considered when taking decisions on development, investments and when formulating annual budgets. The framework of "Resources – People – Planet" aims to alert policy makers that Jigawa State needs to grow within planetary boundaries and that current decisions and budget allocations that target short-term growth can affect the lives of future generations. The study argues this in practical examples rather than in academic language: for example, it calculates that the extensive use of chemical fertiliser (to which a large percentage of Jigawa State's agricultural budget is allocated) leads to soil degradation, whilst the production of organic fertiliser not only protects soil fertility for current and future generations of Jigawa farmers, but reduces the cost of fertiliser and creates jobs at the same time.

The study is meant as a starting point for discussions between policy makers and civil society in Jigawa State. If Jigawa stakeholders were to enter into a dialogue around greener development options for the people of the State, they would become trail blazers for the whole of Nigeria as the country experiences the serious impacts of climate change in various ways without this becoming a point of fruitful engagement between policy makers, the private sector or civil society.

Table of Contents

1 1. BACKGROUND

1.1 Climate Change and Nigeria

Nigeria is one of the most negatively impacted countries in Africa as a result of climate change. The country's risks are particularly high due to its low lying coastline which is densely populated and has a heavy concentration of industry and infrastructure. In addition, the north of the country forms part of the Sahel which is at risk of further desertification and droughts. Flooding, water shortages, increased diseases and associated social disruption are starting to form a vicious cycle of economic degradation and social conflict[1], with women being the most vulnerable.

Nigeria is likely to suffer increasing levels of climate change impacts because of its geographical location and weak institutional, human, economic, technological and financial capacity to cope with the multiple impacts of these disruptions. Vulnerability to climate change is compounded by the over dependence on climate sensitive sectors, especially agriculture. Millions of Nigerians experience food and water shortages and have to deal with inadequate crop harvest, crop failures, animal diseases, lack of water and pasture for animals. Climate change is adding a new challenge to Nigeria's development efforts. Overcoming the development challenge of climate change requires that more extensive adaptation than is currently being applied is necessary to reduce vulnerability to future climate change. Future vulnerability will depend not only on the degree of climate change but also on the development pathway taken, as well as capacity put in place to cope with the climate change stress. Enhancing the adaptive capacity and increasing resilience can accelerate the pace of progress towards sustainable development. In this regard, any effective national development planning process and effort must take climate change into account—and, more particularly, must facilitate adaptation to the effects of climate change. In particular, adaptation needs to be mainstreamed into aid programs and projects[2].

Climate change works as a threat multiplier as it intensifies conflict by increasing migration, causing damage to infrastructures such as power plants and communication equipment and intensifying the battle for resources such as water.

"If not addressed in time, climate change is expected to exacerbate Nigeria's current vulnerability to weather swings and limits its ability to achieve and sustain the objectives of Vision 20:2020.[3]"

[1] ERM, Impact of Climate Change on Nigeria's Economy, DFID Report, 2009, www.atpsnet.org/Files/wps62.pdf

[2] Towards enhancing the adaptive capacity of Nigeria: a review of the country's state of preparedness for climate change adaptation, Heinrich Boell Stiftung, 2010

[3] World Bank report 2013, Toward Climate-Resilient Development in Nigeria

According to the World Bank's study on Nigeria's climate resilient development[4], climate change is at the heart of development and economic growth in Nigeria. If not taken seriously as a development challenge, neglecting climate factors could lead to very serious impacts on Nigeria's growth:

- Long term decline of GDP of up to 4.5%
- Longer term reduction in crop yields of up to 20-30 per cent
- Declining productivity of livestock, with adverse consequences for livelihoods
- Increase in food imports, up to 40 per cent for rice in the long term

In order to deal with these impacts, Nigeria is required to develop integrated climate change, conflict and migration resilient strategies, plans and policies – and implement them. So far, Nigeria has adopted a National Policy on Climate Change[5], drafted a National Adaptation Strategy and Plan of Action (NASPA)[6], and has a host of agricultural, water, forestry, energy and other policies that touch upon climate issues, although some of the latter policies do not take into account the scale of the climatic threats and are not integrating plans across ministries and sectors. The key policy challenge is that the documents remain largely unimplemented.

The 'rainmakers': Climate Change taken seriously?

One of the reasons why climate change adaptation is slow in Nigeria is that Nigerian politics is hardly taking note of the impending climate challenges. Awareness in the National Assembly is low (the members of the Climate Change Committee of the House of Representatives are referred to as the 'rain makers'), and so is awareness within Ministries at federal and state level, despite the existence of an Inter-Ministerial Committee on Climate Change.

Apart from broad assessments, mostly funded by international agencies (like the above mentioned World Bank study and its predecessor drafted by DFID[7], or the Christian Aid funded study, *Low Carbon Africa: Nigeria*[8], there is little region-specific investigation of the potential impact of climate change on the economy. Consequently, Nigerian development policy lacks the necessary climate proofing, both at federal and at state level. Nigeria's official development vision and policy, called Vision 20:2020, contains climate considerations, but has some proposals which stand at variance with the principles of sustainability, including the promotion of coal for electricity production when current international best practice promotes the phasing out of coal.

Mainstreaming Climate Change

The need to integrate climate change adaptation into development planning and decision-making processes has become increasingly apparent with the general recognition that only a low carbon development will provide long lasting answers to millions of Nigerians challenged by

[4] ibid
[5] Unpublished at the time of writing, Nov 2012
[6] BNRCC, National Adaptation Strategy and Plan of Action on Climate Change for Nigeria, November 2011, see www.nigeriaclimatechange.org
[7] See footnote no.1
[8] www.christianaid.org.uk/images/low-carbon-africa-Nigeria.pdf

unemployment, desertification, sea level rise, migration and conflict. As the knowledge increases of how climate change can jeopardise many development efforts and how its impacts can compromise the achievement of the Millennium Development Goals, so the awareness shuld increase that policies need to be climate proof and integrated. Furthermore, the concern that some development activities may contribute to greenhouse gas (GHG) emissions and thus exacerbate climate change necessitates an improved understanding of the synergies between development and adaptation, and how integration can be exploited to address the root causes of vulnerability.

1.2 Focus of the Jigawa State study

"A budget reveals developmental priorities"

In a political environment where policies often remain un-implemented, it is the budget that can reveal a clearer picture of development priorities. This study sets out to analyse Nigeria's budgetary commitment to sustainable development. However, instead of focusing on the national budget, which has a track record of opaqueness and non transparency in Nigeria, this study focuses on one of the 36 states that make up the Federal Republic of Nigeria.

Jigawa State stands out from the rest by its track record over the recent years of actually disbursing the majority of funds budgeted for in its annual state budget. The state also excelled by developing a 2010 – 2012 Comprehensive Development Framework (CDF) which is "a home-grown and holistic approach to development in which the structural, human and physical development needs of the State are articulated within its sustainable fiscal capacity and fundamental objectives"[9] and aims to deliver by the following means:

Sustainable fiscal capacity and fundamental objectives

- *Provision of robust and functional physical infrastructure, particularly roads and transportation; power generation and distribution; and information and communication technology (ICT);*
- *Agricultural development to achieve food security and enhance farmers' income;*
- *Youth and women empowerment; other poverty reduction programmes;*
- *Human capital development through the provision of qualitative and functional education; effective and efficient healthcare services; and potable water supply and sanitation services*[10].

[9] Jigawa State Comprehensive Development Framework Document, 2010
[10] Jigawa State Comprehensive Development Framework Document, 2010

By understanding how aware the budget and policy planning processes in Jigawa State are to the climate vulnerabilities described above, and by describing the existing and missing linkages between development and sustainability planning and policy making in Jigawa State, the study puts a figure on the economic benefits that could arise from achieving synergy between both.

The study aims to draw attention to the need for integrated planning towards sustainable development in a climate, migration and conflict impacted world by estimating how much money could potentially be saved from the current approach of formulating and implementing stand-alone policies that each have the development of the state as objective, but in the end may not address long-term sustainability issues, which more integrated approaches to planning might yield more efficiently.

In order to inspire debate about a greener development path for Jigawa State, the study compares a budget of the recent past (i.e. the year 2010) with a hypothetical budget based on a scenario of climate awareness to show how such integrated planning would have addressed long-term sustainability questions more efficiently, with savings going towards achieving a more ***socially inclusive, sustainable*** development. In order to reflect high priority development goals for the state, the study focuses its hypothetical comparisons on the following three sectors:

- Agriculture and Irrigation, with emphasis on poverty alleviation and job creation
- Energy
- Environment.

By putting monetary figures on these development policy questions, the study hopes to get the attention of policy makers, civil society, the business sector and a wider public and encourage a reflection on the development and growth potentials in a climate stressed world.

1.3 Jigawa State – basic facts & figures

Jigawa State has a total landmass of 24,742 square kilometres. A large proportion of this is certified to be arable land. Ground survey data from the Jigawa State Agricultural and Rural Development Authority (JARDA) indicates that Jigawa State has a total *fadama* (wetlands) size of 3,433.79 km which represents about 14% of its total landmass.

The state's economy is largely characterised by informal sector activities with agriculture as the major economic activity. Over 80% of households in the state derive their income from farming, including animal husbandry. With its agriculture based economy and a population of 4.4 million people, the state has a high potential for both production and consumption.

According to the 2007 Nigerian Poverty Assessment[11], the incidence of poverty in Jigawa State is 90.9%, the highest in the country. The survey puts the severity of poverty in the state at 24.6%,

[11] National Bureau of Statistics, 2007

which again ranks among the highest in the country. This pushes poverty alleviation and job creation high on the list of development priorities for the state government.

80% of Jigawa households derive their income from farming
90% of Jigawa people are considered poor

With about 3.11% of the Nigerian population, Jigawa State ranked 8th among the most populous states in Nigeria. The population of the state, based on the 2006 Population Census,[12] is 4,361,002 of which 50.4% are males and 49.6% females. 85% of the population of the state live in rural areas. Population density is estimated to be 178 people per sq km. This is above the average national population density of 139 people per sq km as at 2006. In terms of age distribution it is estimated that about 42.2% are below the age of 15 years, 49% are between 15 – 59 years while 8.8% are 60 years and above. Based on national estimates, life expectancy at birth in Jigawa State was 47.8 years - 47.2 years for males and 48.5 years for females (as at 2008).

The daily per capita public water supply is 30 litres with the proportion of total daily water requirement obtained from private water supply being between 40%-59%. The overall literacy rate in 2002 was 37% (22% women and 51% men), with the primary school enrolment rate of 29.6%.

Jigawa State has a surface water volume of approximately 477 mcm (streams, rivers and ponds), ground water volume of 30,000- 40,000m3 per km^2 yearly and water recharge is 3,676 mcm /year from rainfall. Jigawa has 20 major surface irrigation schemes and 14 borehole-based irrigation schemes in the state. Some of these irrigation schemes are located in *fadama* (wetland) areas, e.g. the Hadejia Valley Project, which consists of a vast expanse of irrigable fertile *fadama* land covering over 4,800 hectares[13]. This shows the huge potential of increased agricultural yields via better irrigation.

1.4 Methodology of the study

A multi disciplinary expert team consisting of a development economist, a development expert with special expertise in political economy, a climate change expert and an environmental and social safeguards specialist with expertise in green alternative options was put together to jointly have a look at the options before Jigawa State.

"Information from the people for the people"

In undertaking this study, the study team travelled to Jigawa to collect information firsthand and to have consultative meetings with different stakeholders such as relevant state ministries and members of civil society. Much of this fact finding visit was facilitated by two UK AID funded

[12] Federal Republic of Nigeria Gazette No. 2, Volume 96 of February, 2009
[13] Medium Term Sector framework for Agriculture (2010-2012)

projects, the States Accountability and Voice Initiative (SAVI) and the State Partnership for Accountability, Responsiveness and Capability (SPARC).

Particular emphasis must be placed on the fact that this report will remain a draft and is aimed at inspiring debate on the most beneficial development path for current and future generations of citizens of Jigawa State. What people do with this report will be more important than what is written here.

2 ANALYSIS

2.1 Jigawa State's Comprehensive Development Framework (CDF)

The CDF and its conceptualisation of development objectives and policies

'Development' is about increasing goods and services, increasing access and opportunities, increasing freedom and choices, and sustaining these gains over time. Climate change can undermine or, in some cases, reverse the effectiveness and sustainability of development interventions. What's more, some interventions can unintentionally leave people even more vulnerable than before to worsening droughts and floods, changing rainfall patterns, sea level rise and other impacts of climate change. Conversely, well designed development activities can increase people's resilience to these impacts.[14] It is with this understanding that this study aims to look at the Jigawa State CDF 2010-2012 and the state's 2010 budget with a view to determining if in providing the necessary inputs, the State development strategy envisaged unsustainable use of the planet (including non-financial resources), people and financial resources.

Jigawa State in its Comprehensive Development Framework 2010 has identified and articulated the strategic objective of their development policies as follows[15]:

[14] CARE Toolkit for Integrating Climate Change Adaptation into Development Projects http://www.careclimatechange.org/tk/cba/en/

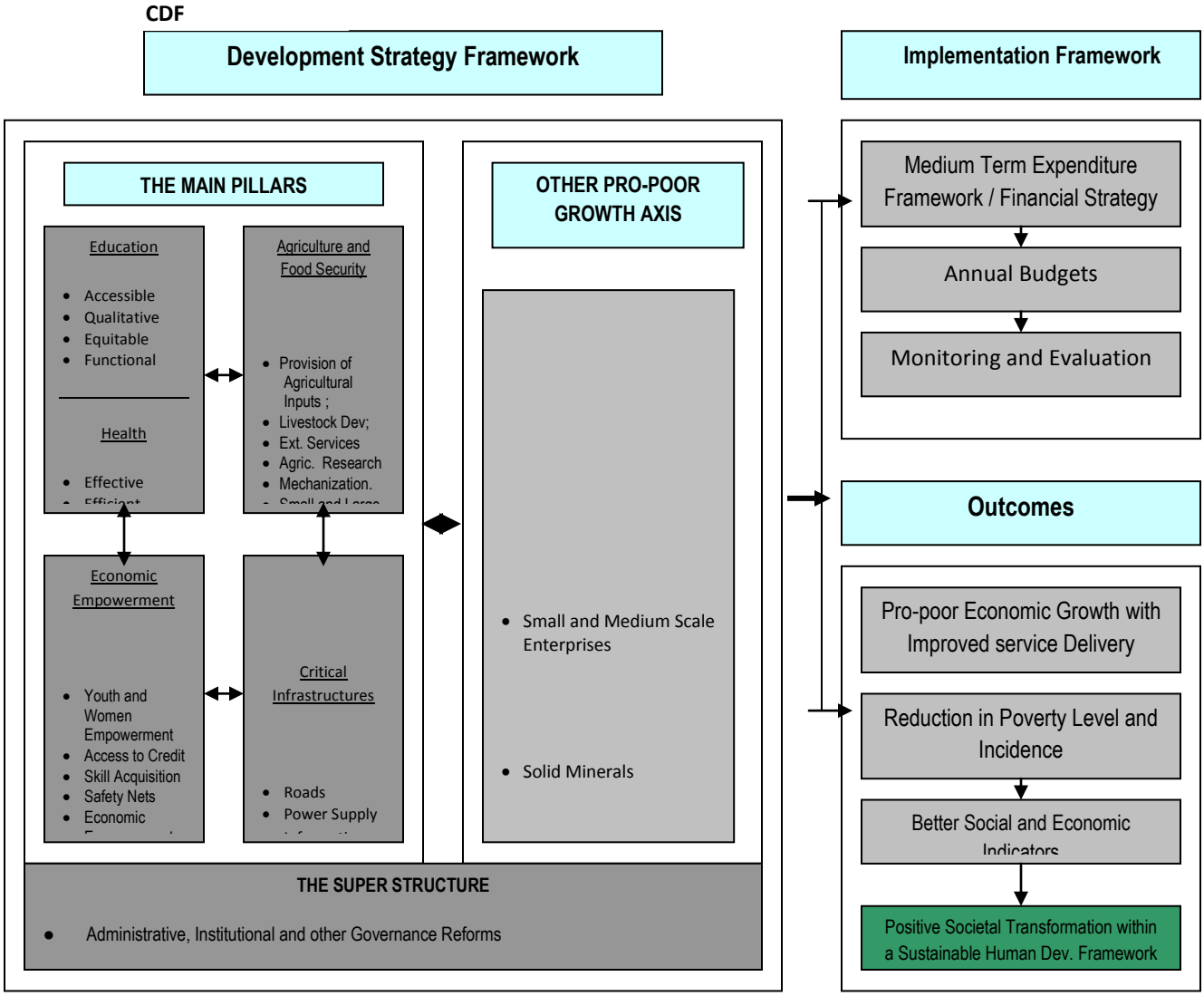
[15] Jigawa CDF, 2010-2012: page 14

"To improve the socio-economic well-being of the people...[which] will be achieved through pursuit of policies that would not only guarantee economic growth but also ensure ***sustained progress*** in the improvement of basic human development indicators"

The main pillars of the CDF break the above goal into four areas of priority attention:

- Education
- Agriculture and Food Security
- Economic Empowerment
- Critical Infrastructures

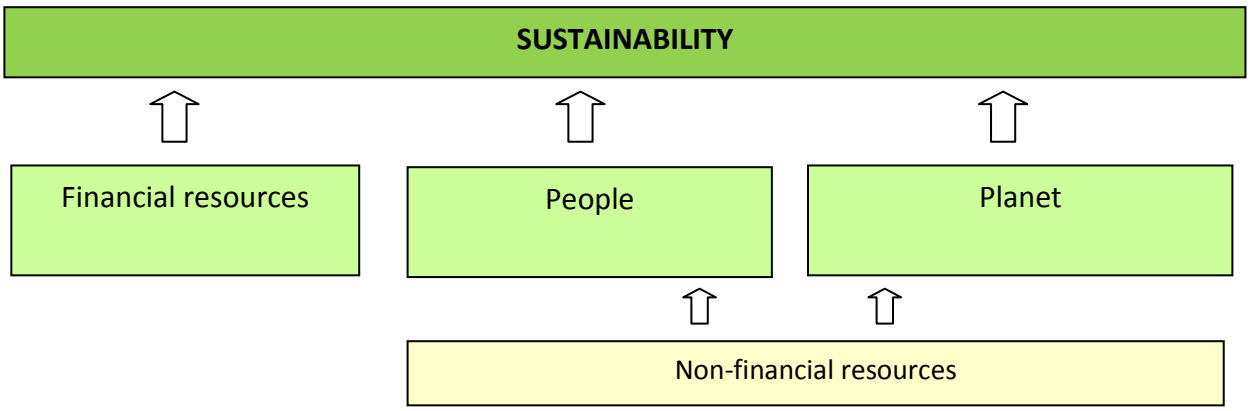
as listed in the CDF's graphical illustration:



As seen in its summary table, the CDF drives budget allocation towards achieving the goal of *sustained progress in the improvement of basic human development indicators.* However, the concepts that underlie the CDF are rooted in the immediate present or near future and focus mainly on achieving growth and economic development without checking for the long-term environmental cost that might be attached to the desired growth.

Greening the concept of sustainability

As such, the CDF does not explicitly conceive sustainability to include the long-term dimension which is reflected in the following three components that make up sustainability in the opinion of the authors:



The focus in the CDF on the here-and-now is certainly justified given the immediate needs of most citizens of Jigawa State, however certain pertinent questions must be asked. Looking through the 3 goals given in the Medium Term Sector Framework for Agriculture, and the strategy set out to achieve the goals, questions must then be raised on the sustainability of such strategies *vis-à-vis* their implementation, for example:

- If a high dose of synthetic fertiliser reduces soil fertility, how much arable farmland will remain in 2020?
- If economic growth for Jigawa State is tightly linked to a steady (although avoidable) increase in CO2 emissions, for how long will Jigawa State be able to pursue this growth model?

The narrow conceptualisation of sustainability allowed the development strategy to aim only at maximising the use of financial resources described as sustainable revenue and sustainable allocation.

Greater political choice can be exercised to optimise the impact of spending on available resources (financial), the people and the planet (non-financial resources), but this would necessitate a more integrated approach to planning for sustainable development. Smart political choice ensures sustained positive outcomes for all three variables.

Within the current conceptualisation of the development process, as contained in the CDF, spending is based on availability of resources (or "sustainable revenue") and not sustainability. Choices and trade-offs within the development framework were made on the basis of resource availability alone, rather than on the basis of sustainability.

2.2 Budget Priorities of Jigawa State in 2010

This section analyses whether the 2010 budget put into practice the development goals as stated in the CDF. A look at theory versus practice is necessary as all too often in Nigeria, a policy document is drafted, negotiated, approved – and then relegated to a life on the shelf. We were intrigued to discover that two out of the four main pillars of the CDF were given priority – with road development (Critical Infrastructure) as the biggest item on the budgetary agenda with a wide margin, followed by Education.

2010 capital budget allocations, in order of volume of allocation in reference to total budget:

- Road development - 30 %
- Education - 17.3 %
- Institutional development - 15.98 %
- Health and social services - 10.69 %

The two other pillars of the CDF - Agriculture and Economic Empowerment - did not figure in the first four slots of capital allocations.

In terms of implementation, this re-prioritisation towards roads became even more accentuated with 45% of the actual capital spending devoted to Roads and Transport development. Put differently, while 87% of the capital budget was implemented, Roads and Transport received 129% of what was originally budgeted for it. Administration and Housing development received 84% and 83% respectively.

The focus areas of this study, Agriculture and Irrigation, Energy and Environment, received a capital allocation of 17.6%, but only 11% was actually spent on these areas. In other words, even though they are areas which have a more direct link with the climate change concerns and are critical to the attainment of sustainable development, they were given only 55% of what was originally allocated.

2.3 Sector analysis of the 2010 capital budget

2.3.1 Agriculture

The CDF identifies agriculture as a key policy area to achieve poverty reduction, especially among rural poor, as over 90% of Jigawa's population[16] engage in agriculture. The CDF lists the following targets for agriculture:

- Increase in agricultural productivity (higher farm yields) by 10% during the period 2009 to 2011;
- Reduce post-harvest losses by 25% for both cereals and vegetables by 2011;
- Increase profitability of agricultural production by 20 to 30 % by the year 2011.

It is estimated that about 1.6 million hectares (out of the state's 2.4 million hectares of landmass) can be cultivated during the rain-fed season, while about 308,000 hectares is cultivatable during the dry season through irrigation. The potential for agriculture is therefore huge in the state.

Without doubt, fertilising and irrigating farmlands must be high priorities to achieve the first goal of increasing yields by 10%. However, looking at the 2010 capital budget, chemical fertiliser was given a clear priority in the volume of capital allocation.

- 90% of the population engages in agriculture
- 0.14% of the total capital spending on agriculture was spent on **irrigation**, despite the state's great potential in irrigation;
- 85% of actual capital spending in the agriculture sector in 2010 went towards procurement of chemical **fertiliser** and poverty alleviation.

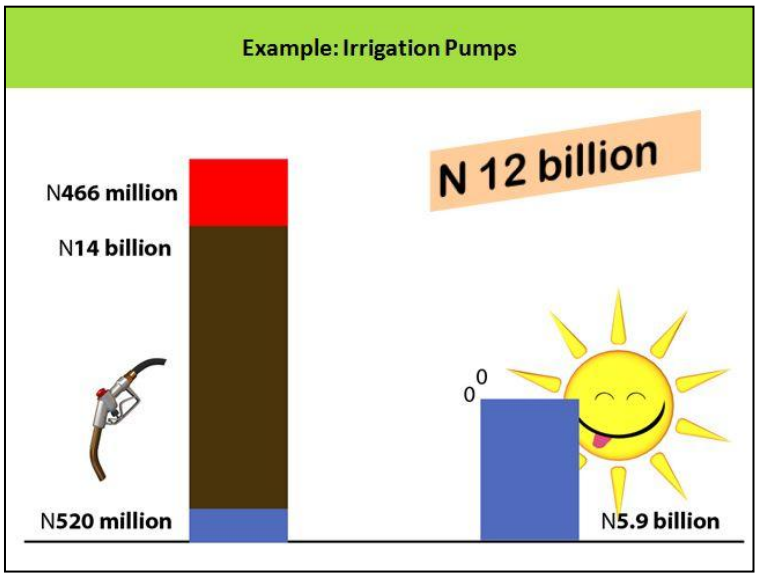
2.3.1.1 Land tenure

Land tenure is the system of rights and institutions that govern access to and use of land and other resources. Previous attempts to monitor food security in climate constrained areas recognise access to productive land as one of the most important factors in determining household or individual food security, and thus development[17]. Research on land tenure suggests that the most apparent qualitative linkage is one of changes in tenure security; which shows that increased security of tenure in productive resources enables more efficient and profitable agricultural production, and hence greater access to food.

[16] While CDF refers to 90% farmers, the National Bureau of statistics indicate 80% who "derive their income from farming".
[17] Maxwell and Wiebe; Land Tenure and Food Security: Exploring Dynamic Linkages 1999

2.3.1.2 Comparison fuel pumps vs solar pumps for irrigation

The 2010 capital budget planned for the drilling of 10,000 shallow tube wells and the purchase of 10,000 water pumps to create small scale irrigation plots. Given the high rate of unemployment in the state and the vulnerability of youth in an environment where extremism is on the rise, this is certainly a laudable measure. What the 2010 budget plans did not calculate, was the long-term cost – monetary cost, and cost of impact on people and planet – of running fuel-powered water pumps over a long period of time.



We calculated the cost of running fuel pumps with solar pumps as follows:

	Fuel pumps	Solar pumps
Purchase cost 10,000 pumps	N 520 million	N 3.2 billion
Running cost over 10 years (purchase of fuel)	N 14 billion	N 0
Environmental cost over 10 years (price of carbon/tonne: US $ 7)	N 466 million	N 0
***Total cost over 10 years**	**N 15.1 billion**	**N 3.2 billion**
Potential savings		**N 12 billion**

*Calculation and detailed breakdown of costs in Annex 5.3.

Had the State government decided to purchase solar powered irrigation pumps, the state could have saved about N 12 billion over a period of 10 years. The savings are mainly derived from not having to buy fuel for the conventional water pumps. But there are benefits beyond the value in Naira: the solar pumps do not emit CO2 and thus are contributing to the fight against climate change, from which Jigawa State is suffering so immensely. In fact, as the international regime to reduce CO2 emissions is being re-negotiated, it is expected that in future, CO2 emissions will be penalised by financial means, and our example here has calculated the current cost of a tonne of CO2 (as traded on the EU carbon market).

2.3.1.3 Comparison chemical vs organic fertiliser

During 2010, Jigawa State released more than N 900 million for the procurement of chemical fertiliser: the allocated ₦934,749,124 would have bought an estimated 7,000 metric tonnes of chemical fertiliser, also factoring in transportation, handling & logistics. A smaller amount of money could have bought an entire factory to produce organic fertiliser. This would have created more than 500 local jobs for collectors of organic waste, thus reducing the budget allocations for poverty reduction.

A quick comparison of the two options shows the long-term benefits in financial terms, but also for people and planet:

	Chemical Fertiliser	**Organic Fertiliser**
Purchase cost	**N 900m** to purchase 7,000 metric tonnes per year	**N 750m** for fertiliser factory – 10,000 metric tonnes per year
Economic Dividend	Farmers at the mercy of fertiliser distribution systems	**Farmers' own** fertiliser, Creates **local jobs** (more than 500 waste collectors for the factory)
		Increase of production of 3,000 metric tonnes per year
Environmental impact	Has a large carbon footprint	Long-term **protection of soil fertility**
***Total cost over 10 years**	**N 9 billion**	**N 750 million**
Potential savings over 10 years		**N 8.25 billion**

*Calculation and detailed breakdown of costs in Annex 5.4

Looking at the potential benefits of organic fertiliser, the long-term savings in relation to higher soil fertility cannot be overestimated. If we consider the sustainability of the agriculture sector, organic fertiliser should be used as much as possible. Organic fertilisers are natural materials of either plant or animal origin, including livestock manure, green manures, crop residues, household waste, compost and woodland litter. Organic fertilisers differ from chemicals in that they feed plants while building the soil's structure. Soils with lots of organic material remain loose and airy, are better able to hold moisture and nutrients, foster growth of soil organisms, including earthworms, and promote healthier root development.

Chemical fertilisers will not improve the structure of the soil. In fact, because they are composed of high concentrations of mineral salts, they are capable of killing off many of the soil organisms that are responsible for decomposition, and soil formation. If only chemicals are added, the soil gradually loses its organic matter and microbiotic activity. As this material is used up, the soil structure breaks down, becoming lifeless, compact and less able to hold water and nutrients.

The increased introduction of organic fertiliser into Jigawa State would build self-reliance, self-sufficiency and capacity for farmers in accordance with Jigawa State Government policy and contribute to economic empowerment through job creation. By recycling their agricultural, animal as well as human waste, farmers can produce their own fertiliser and hence reduce the costs tremendously. 200,000 households can produce 300,000 tonnes of organic waste/ year, and these 300,000 tonnes can produce 10,000 metric tonnes of organic fertiliser/ year. Given, that the production of this quantity is professionalised, 500 jobs (paid by revenue from fertiliser sales) can be created by an investment of ₦750,000,000 only, to build an organic fertiliser factory providing enough organic fertiliser for the whole of Jigawa.

2.3.1.4 Comparison: Agriculture funds released vs fund budgeted

Barely 9% of total budget went to Agriculture, and actually only half of it was spent

In concluding this section on the 2010 capital allocations to agriculture, we would like to note that only fertiliser procurement, disease control and poverty alleviation received more than 70% of what was initially budgeted, according to Jigawa State's budget analysis:

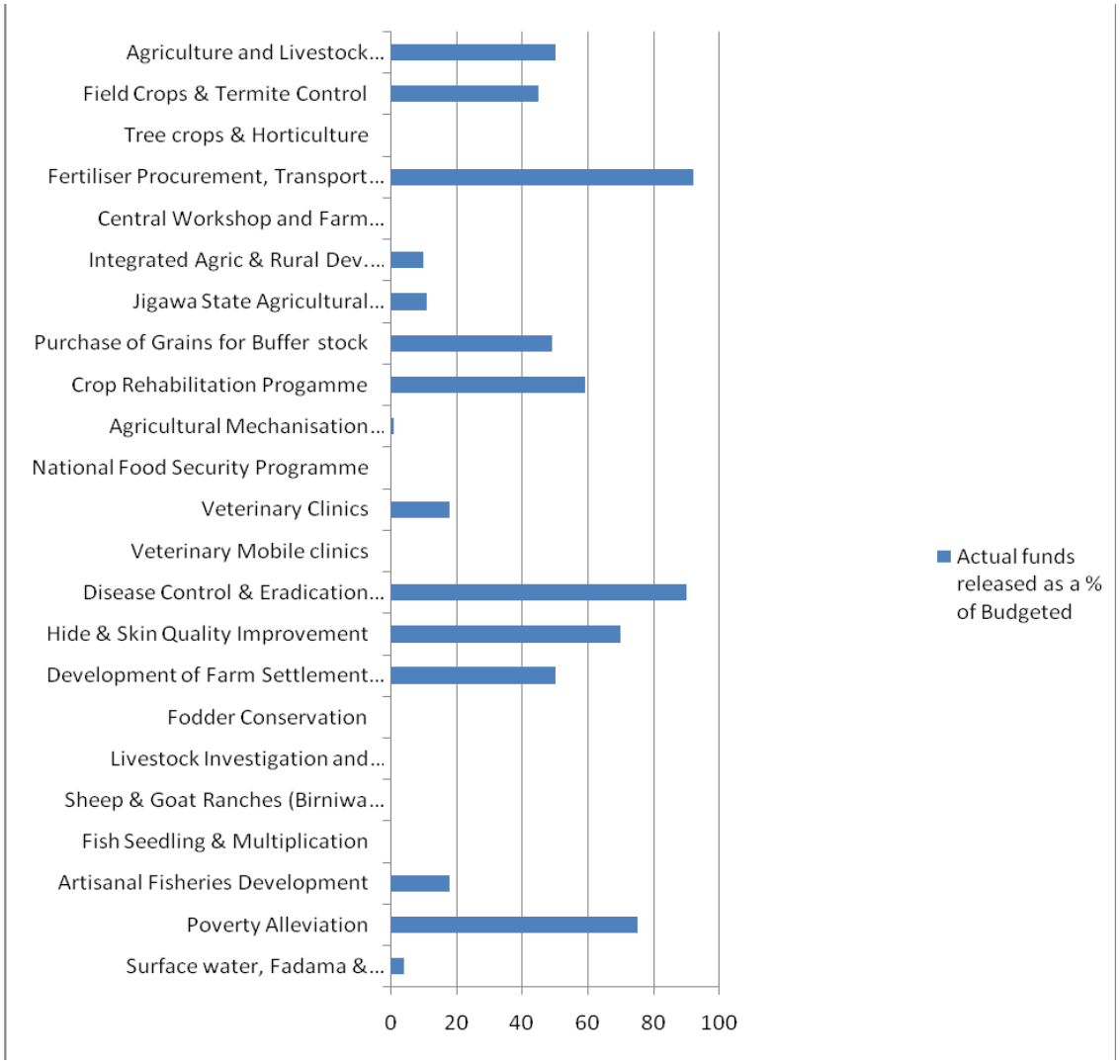


Figure: Showing the actual funds released for agriculture as a percentage of budgeted

The data set available to the authors did not allow a detailed analysis of the linkages between the different agricultural sub-sectors. Line items such as “Integrated Agric & Rural Development” and “Poverty Alleviation” could not be fully investigated, even though they would promise great potential in achieving the vision of the CDF. For example, on integrated farms, waste is routinely turned into organic fertiliser and the allocation to poverty alleviation might contain a job creation scheme that allows young Jigawans to cater for themselves and contribute to food security for the state. On the sceptical side, line items such as “Hide & Skin Quality Improvement” might point to toxic wastes from tanneries affecting water quality, a problem which has in the past often been left unattended to in northern Nigeria.

A more detailed analysis would throw up more food for thought on how the capital budget spending could be rendered more efficient and impactful, but we hope to have contributed to a fresh debate by lining up the above arguments.

2.3.2 Energy

2.3.2.1 The Energy Budget 2010 - 2012

The Comprehensive Development Framework of Jigawa State has set four major goals for the energy sector for the period between 2010 and 2012. These are:

- Ensuring at least 30% and 50% coverage for households with electricity supply by 2012 and 2020 respectively;
- The state to generate at least 10% and 50% of its electricity demand by 2012 and 2020 respectively;
- Doubling the rate of contribution of this sector to economic growth and rate of employment in sectors that rely on electricity by 2020;
- Upgrading and strengthening the existing 500km and 1000km of 33 kW distribution lines by 2012 and 2020 respectively.

To achieve these goals, the 2010 budget allocated a total of ₦ 1.12 billion (or 2.67% of the total capital expenditure) for energy, but only ₦641 million (or 57.26% of allocated funds) was actually released. Within the sector, however, preference appears to be given to the completion of on-going rural electrification projects, development of alternative energy sources and the new rural electrification projects. About N596 million or 93% of the total allocation to the energy sector were spent on these projects.

Only 14% of the energy budget allocated for greener sources of electricity.

It is however noticeable that most of the money allocated to the energy sector was spent on electrification projects (about 78%) which involve a connection to the national grid, and only 14% was spent on developing alternative sources, including renewable environmentally friendly sources.

Allocations within the Energy Budget – priorities, budgeting vs release		
Total energy budget allocation	N 1.12 bn	= 2.67 % of the total capital expenditure
Total release 2010	N 641 m	= 57.26 % of allocated funds
Allocation to: - on-going rural electrification - new rural electrification - alternative energy	N 596 m	= 93 % of total allocation
Allocation to greener sources of energy	14 %	
Allocation to electrification as part of national grid	78 %	
Allocation to decentralised renewable energy systems	14 %	

2.3.2.2 Energy requirements in Jigawa

Energy is one of the key fundamentals for economic development, but about 50 % of Nigeria's population lacks access to electricity. The major inhibiting factors to electricity generation, transmission and distribution to rural areas are issues such as geographic remoteness, cost of transportation and poor government commitments.

For a typical rural household, small scale business and businesses related to agriculture which is the mainstay of the economy of Jigawa state, the energy requirement for rural households range between 0.28kwh/day -4.14kwh/day, which will add up to about 100kwh-1500kwh per year.

Table: Economic Activities and Energy Requirements in Rural Areas

	Activity	Use	kw/h
1	Agro-processing	• Flour grinding • Oil expelling • Crop drying • Threshing	1-2 2-5 - -
2	Small Scale Industry	• Saw milling • Wool and Cotton Processing • Stone crushing	10-30 5-25 5-25
3	Household	• Lighting • Refrigeration • Cooking • Water pumping • Ironing • Radio/TV	0.2 0.3 0.4 (Heat storage cooker) 0.5-1 0.5 0.1-0.3

Source: Muhammad Ladan, 2009[18]

2.3.2.3 Contrary to popular belief: Solar pays off

The lack of easy access to information, and the importation of sub-standard renewable energy technology have led to an unfortunate apathy towards the uptake of the different renewable energy options. Many policy makers, business people and consumers are not aware of the economic viability of renewable energy systems. However, the argument that renewable energy is more expensive than conventional electricity produced with oil or gas, does not hold[19]:

	Cost of solar powered electricity	Cost of diesel powered electricity from a generator
Algeria	0.20 – 0.40 Euros per kWh	0.03 – 0.40 Euros per kWh
Benin	0.20 – 0.60 Euros per kWh	0.30 – 0.45 Euros per kWh
South Africa	0.03 – 0.30 Euros per kWh	0.20 – 0.35 Euros per kWh

[18] Professor Ladan: Policy, Legislative And Regulatory Challenges In Promoting Efficient And Renewable Energy For Sustainable Development And Climate Change Mitigation In Nigeria, 2009

[19] European Commission News Release: Screening Africa's Renewable Energy Potential, http://publications.jrc.ec.europa.eu/repository/handle/111111111/23076

Kenya	0.40 – 0.80 Euros per kWh	0.20 – 0.40 Euros per kWh
Nigeria	0.20 – 0.60 Euros per kWh	0.20 – 0.45 Euros per kWh

The primary objective of Nigeria's national rural electrification policy is to expand access as rapidly as can be afforded in a cost effective manner. The policy includes a full menu of options which include grid and off-grid options, particularly renewables, while ensuring close coordination of rural electrification expansion with economic development objectives and encouraging states, local communities as well as private sector to develop and contribute financially to rural electrification[20].

Building decentralised energy systems ensures optimum use of the existing sources of energy. One of the most important benefits of decentralised energy systems is that it takes very little time to install a new one. The time needed to identify, develop, negotiate, build and start a decentralised energy project is significantly shorter than for large centralised power plants. On average, 5 to 7 years are needed to start up a conventional power plant, and between 6 and 18 months for any type of decentralised energy application.

The revised Renewable Energy Master Plan envisages that Nigeria produces 30,000 MW of electricity from solar before 2030. The authors regard this as a rather conservative estimate. Much of the solar potential lies in northern Nigeria, including Jigawa State. Solar has the potential to spur development in the interest of people and planet, with a higher initial investment cost, but with lower recurring costs (see above example of solar water pumps for irrigation).

Biogas and solar are two renewable and environmentally friendly sources of energy which can be harnessed in Jigawa State to provide off-grid solutions to the current paucity of households with access to electricity, as has been the case in countries like India and China who have successfully used alternative energy systems in tackling the lack of electricity supply for low income homes.

2.3.2.4 Biogas: No 1 choice for rural areas

Studies have shown that household anaerobic digesters could reduce fuel wood consumption by 53%, with each household potentially saving up to a calculated 250 kg of firewood per month and saving 3 tons of firewood per year[21].
Anaerobic digesters can treat livestock waste and household food scraps onsite to produce biogas (methane and carbon dioxide) in rural areas In small scale digesters, methane fuel as an alternative to traditional three-stone fires, improved cook stoves, and liquid petroleum gas can then be used for cooking and lighting. Small sized biogas digesters can be used to power low wattage equipments including: shaving clippers, hairdryers, light bulbs, cook stoves etc, hence the possibilities of small scale self employment are enormous.

In fact, biogas production at household level is likely to produce more energy than a typical household in Jigawa State would need: an average rural family uses an estimated 2 kWh of

[20] On rural Electrification Policy, see chapter 7 of the National Electric Power Policy 2001, supra note 20, at pp.240-241. See also the "Renewable Electricity Policy Guidelines, December 2006" Federal Ministry of Power and Steel Federal Republic of Nigeria.
[21] Design of Small Scale Anaerobic Digesters for Application in Rural Developing Countries: Laurel Rowse, 2011.

electricity per day. An average Jigawa family with one cow (generating 10 kg of cow dung per day) and producing domestic waste of about 5 persons could produce more than 6 kWh of electricity per day[22].

How could this household level of electricity production be used to achieve the CDF goal of providing at least 30% of Jigawa households with electricity by the year 2020? One possible answer lays in the procurement of small 1-cubic-metre biogas digesters. Based on the example given above, one such digester could satisfy the basic electricity needs of 2 average households, so if the Jigawa State government wanted to procure biogas digesters for electricity production (although there are many other models to provide infrastructure, rather than government procurement), it would have to invest around N 22,000 per digester, leaving it with a bill of 107,500 digesters x ₦ 22,000, i.e. a total investment of N 2.5 billion over a 3 year period, i.e. from 2010-2012. Compare this to the ₦1.12 billion appropriated for the year 2010, which hypothetically will amount to ₦3.36 billion over three years[23].

2013 target: 30% of households with access to electricity		
	3-year accumulative cost	**environmental cost**
Energy budget 2010, with priority of centralised energy production (PHCN extension)	N 3.36 bn	**High**: 40% of GHG emissions from electricity production
Bio digester programme for households	N 2.5 bn	**Low**: renewable energy plus absorption of methane gases from waste sites

Besides the availability of household waste, Nigeria unfortunately produces an excessive amount of vegetable waste – up to 40% of fruit and vegetables perish before they can be sold or eaten. In the short-term, this constitutes a veritable source for electricity production[24]. However, in the long run it is hoped that most food items can get to consumers on time, thus contributing to food security and addressing poverty issues with the producers.

A note of caution must be applied to any large-scale generation of energy from biomass. As highlighted above in the agriculture section, biomass is needed to produce fertiliser and where biomass is of limited supply; priorities must be set very clearly and must be based on practical calculations to avoid unwanted competition for biomass.

[22] See annexe 5.4

[23] http://www.glowafripower.com.ng/Micro-Grid

[24] See story of Aniche Phil-Ebosie, Lagos, *Papaya Power*, http://ng.boell.org/web/clean-energy.html

2.3.2.5 The potential for Solar in Jigawa

Photovoltaic systems are typically consid**e**red the most expensive renewable energy technology and have in the past been unaffordable for many rural citizens in the developing world. However, the prices for solar equipment have fallen drastically in recent years, and the challenge now rather lies in regulating the emerging solar markets in a way that allows only high quality products to enter into a country, and keeping fake and sub-standard products away.

Power to the people – at little cost

In Zamfara State, 22 communities[25] with a combined population of 70,000 people have been provided with electricity based on solar systems, including 29 health care centres serving basic medical needs. 2000 youths have received job training related to solar modules[26]. A typical 500 kW solar power plant which produces 839,500 kWh of electricity annually (2,300 kWh daily) has an average installation and deployment cost of about N 500 million. Given that a typical rural household has a daily energy consumption rate of 0.28kWh, the installation of a 500KW solar plant can provide 8,214 households with clean renewable electricity at little or no recurrent cost. As mentioned above, Jigawa State actually only spent 57% of its energy budget in 2010. **The remaining unspent N 470 million would almost have bought such a 500kW solar plant**.

Jigawa's solar irradiation is in excess of 6kWh/$m^{2.}$ With a land mass size of 22,410km^2, the total potential irradiation equals 134,460,000kWh per day, although the actual amount which can be harnessed is about 26,892,000 KWh (factoring in the about 20% efficiency ratings for solar panels). **This could potentially satisfy the electricity requirements of 33,615,000 rural households in the state, 5 times the current state household numbers**.

In 2008, the Saminu Turaki administration created the Alternative Energy Fund, which was aimed at funding three solar projects in collaboration with a Washington based NGO called Solar Electric Light Fund (S.E.L.F) with support from USAID estimated at about $280,000. While the projects recorded initial successes in providing solar lighting systems for households and street lightings, it was not sustainable beyond the initial funding period[27]. This example goes to show that more than monetary investment is required to achieve sustainable growth in Jigawa State: the willingness to protect financial investments as well as protecting the people and the planet is at the heart of people friendly development and growth.

2.3.3 ENVIRONMENT

[25] Madobiya, Tsanu, Alawa, Gidan Daninna, Rungar Tudu, Makera, Kungurmi, Tashar Taya, Gidan Kaso, Chigama, Shamushalli, Kokiya, Kukkubi, Tashar Danjuma, Billashe, Yauta Baki, Shagerawa, Tudun Janbuzu, Dan Kurmi, Bindim, Dangulbi and Gobirawa Challi

[26] Usman Muhammad: RURAL SOLAR ELECTRIFICATION IN NIGERIA: RENEWABLE ENERGY POTENTIALS AND DISTRIBUTION FOR RURAL DEVELOPMENT (2012) www.ases.conference-services.net/.../SOLAR2012_0232_presentation.pdf

[27] Huzi Mshelia; Report on the Survey of Climate Change Activities in Jigawa state, commissioned by the Heinrich Boell Foundation; September 2011.

The objective of the CDF as regards the environment is to ensure that environmental exploitation for economic development regenerates and protects the environment, which strategically means the development of agriculture potential without destroying the environment, and consequently conserve biodiversity.

The concrete goals of the environment sector are identified in the CDF as follows:

- Slow down the rate of desert encroachment by half from the current rate of 0.2km per annum to 0.1 km by 2015 and stop it all together by 2020;
- Recover land affected by desert encroachment at the rate of 0.2km per annum starting from 2010;
- Reduce the incidence of malaria among pregnant women from the current 70% to 30% through improved sanitary habits.

Allocation to this sector is among the least, both in terms of amount budgeted and actual expenditure (see table below). **The total capital allocation to Environment was ₦370 million, representing only 0.88% of the total capital budget and from this amount, only 41 percent was actually implemented** (about N153 million).

Ministry of Environment Budget Summary			
Project	**Approved Estimate (₦)**	**Actual Expenditure (₦)**	**% Implementation**
Dutse Erosion Control	50,000,000	4,938,102	9.87
Parks & Gardens for the state capital	10,000,000	0	0
Secondary Forestry Project (World Bank Assisted) JIGAP	10,000,000	0	0
Flood & Control Projects Maintenance JISEPA	75,000,000	47,338,346	63.12
Flood & Erosion Control Projects	120,000,000	58,397,692	48.66
Nature Conservation Programmes	20,000,000	4,978,000	24.89
Environmental Research and Database Development	4,000,000	0	0
Natural Lakes Conservation	4,000,000	0	0
Development of Industrial Gum Arabic	3,000,000	0	0
Forest Extension & Mass Mobilisation Programme (tree planting campaign	4,000,000	0	0
Forest Shelterbelt & Natural Forest Reserve Development	40,000,000	20,616,872	51.54
Forest Nurseries Development and Production of Seedlings	30,000,000	15,764,000	52.55

The low levels of allocations on Environment are highly surprising given the life threatening rate of desert expansion in northern Nigeria. Only half of the N40 million allocated to Forest Shelterbelt/Natural Forest Reserve Development in 2010 was actually released. Even less (N4 million) was allocated to Environmental Research and Database Development of which nothing was released. Taking these low-level allocations together with the rather minimal allocation to irrigation, the authors wonder whether Jigawa State is relying on federal or international funds to fight desert encroachment.

2.3.3.1 Biomass – avoid deforestation by improving wood stoves

Reducing the consumption of firewood

The Sule Lamido administration in an effort to address the lingering problem of indiscriminate felling of trees for cooking requested the Alternative Energy Fund to propose workable solutions for the energy problems by creating access to energy for rural dwellers. The Fund introduced the idea of improved wood stoves and also proposed solar powered street lighting in 19 villages across the state as pilot projects. According to an official of the Ministry of Women Affairs, between 2007- 2010, a total of 43,000 units of the more efficient wood stoves were produced in a factory in the capital Dutse and distributed to rural communities, schools, hospitals and NGOs at a total costs of N 85.5 million. The stoves were given out free of charge, but demand was higher than supplies and people seemed ready to pay a reasonable price for them, indicating a **potential market here that could operate independently of government investment**. In cases such as this, government might benefit more from facilitating the growth of a cook stove market and earn tax income (even if moderate during the start-up period), and restrict its role to regulation and quality control. Both issues are major factors in the development of new markets such as the renewable energy market, as sub-standard products could trigger a negative backlash that would deter consumers and investors alike.

Deforestation being such a central issue in Jigawa State, it needs a cross-sectoral approach ranging from **reforestation** to **agro-forestry** to a drastic **reduction in the consumption of firewood**. All of these approaches carry commercial potential, whereby Jigawa entrepreneurs could earn a living. It is encouraging to note that the challenge of deforestation is already tackled across ministries. The Ministry for Women's Affairs is holding the keys to the Alternative Energy Fund under which Jigawa State has launched its own production of fuel efficient cook stoves in a factory in Dutse. However, stronger linkages across sectors and integration of budget allocations would again increase the effectiveness of the fight against desertification.

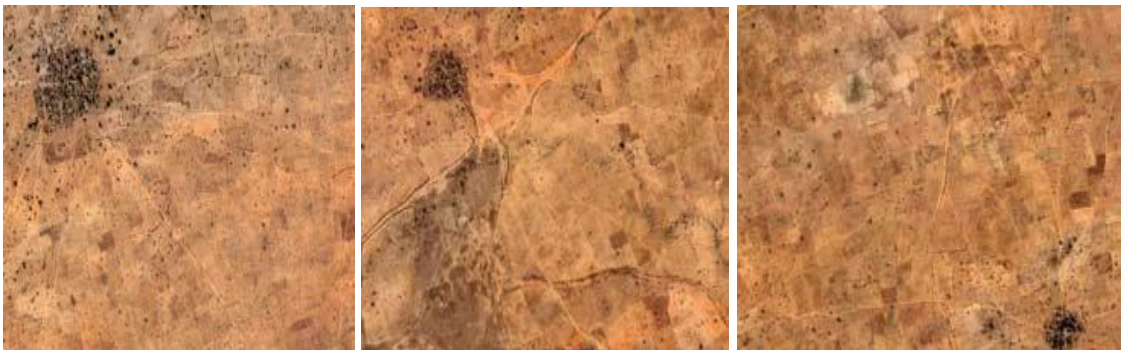
If through the Alternative Energy Fund the cook stove factory could be provided with electricity from renewable sources, its production output could be increased. Through an incentive based tax or subsidy system, young entrepreneurs could be encouraged to take stove production into their own hands, leaving it to government to regulate training and enforce quality control. As demand for these stoves is high in Jigawa, and customers are ready to pay to get their clean cook stoves, this seems like a win-win approach as long as the quality of the stoves is assured in order to avoid a negative backlash by consumers.

2.3.3.2 Combat desertification: Re-Greening the Sahel

Agro-forestry is an approach that increases yields and soil fertility for farmers, with the added advantage of fighting desertification. The *Re-Greening the Sahel* initiative is wide-spread in the Republic of Niger, where satellite pictures show a higher density of trees than in northern Nigeria.

NIGER

NIGERIA



*Pictures by Chris Reij, more information about Re-Greening in Niger at http://www.ng.boell.org/web/agriculture-regreening-the-sahel.html

Re-Greening simply means not to 'clear the land' before planting, i.e. protecting trees and shrubs that grow naturally on the farmland, whilst the crops are planted in-between trees. By nurturing existing trees, farmers create multiple advantages for themselves:

- The trees constitute a windbreak, providing shelter from the sun, from the rain, holding the soil in place, and stimulating soil microfauna and microflora;
- Trees provide shade and reduce the soil temperature;
- Recovery of some of the leached or drained nutrients by the deep roots of the trees, enrichment of the soil organic matter by tree litter and by the dead roots of the trees;
- Falling leaves and other organic manure attract termites and other insects, which break up a caking surface (prone to erosion and flushing away of rich top soil) and allow rain water to sink in. In Re-Greening areas in Niger, ground water levels have risen up to 7 or 10 metres as a result;

- An alternative to full reforestation of arable land, permitting the continuation of agricultural activity on land whose arable potential is therefore conserved;
- In pastoral plots, fodder units can be available at different dates compared to full cropped plots, extending the grazing calendar;
- Re-Greening is low cost and is managed by the farmers themselves.

"Re-Greening has brought back almost barren land to produce substantial agricultural yields in Niger. "

In a Re-Greening area of Zinder, farmers had a surplus of 16,000 tonnes of cereals during the 2011 drought, they started to cultivate previously unproductive areas, obtaining cereal (millet and sorghum) yields of between 300 and 1,500 kg/ha/yr, depending on the level of precipitations. Reports estimate that the annual additional income earned directly by farmers from Farmer Managed Natural Re-vegetation (FMNR) in the Maradi region of Niger is between US$17 – 23 million. Per family, incomes have increased by around USD$200 per year[28] as a direct result of the increased annual production value of each tree, which is calculated as:

APV = (value of firewood, fodder, fruit, medicines, improved soil fertility) – (negative impacts on crop yields (shading), costs of pest increases.)

This technique could contribute substantially to Jigawa State's goal of increased agricultural production. However, money would have to be set aside for knowledge building and sharing. The Re-Greening approach makes business sense: the total wood and arable production from an agro-forestry plot is greater than the separate production obtained by an arable-forest separate cropping pattern on the same area of land. And by reducing greenhouse gases, which are absorbed by the larger number of trees, Re-Greening becomes a sustainable approach to agriculture in a climate stressed, arid area.

Reforestation efforts in general have unfortunately largely stayed behind their set goals, but Jigawa State is actively pursuing such efforts in an attempt to provide a green buffer zone against the advancing sand dunes. International climate finance instruments like REDD+ could provide an additional source of income to Jigawa State.

Desert encroachment can be reduced by half through planting of various species of trees such as Neem (*Azadirachta indica*), *Eucalyptus sp*, *Moringa oleifera* and many more. The benefits of these trees are much more than combating desertification, they can also be harnessed for economic benefits hence helping to reduce poverty.

2.3.3.3 Afforestation can fight malaria

According to estimates[29], sub-Saharan Africa's GDP would have been up to 32% greater in the year 2000 if malaria had been eliminated 35 years ago. This would represent up to $100 billion added

[28] World Vision; FARMER MANAGED LAND REGENERATION- An effective approach to restoring and improving agricultural, forested and pasture lands

[29] **Press Release** Malaria Foundation International, Africa Summit on Rollback Malaria 2000 http://www.malaria.org/news239.html

to sub-Saharan Africa's current GDP of $300 billion. This extra $100 billion would be, by comparison, nearly five times greater than all development aid provided to Africa in 2011.

According to the report of the Malaria Foundation International, malaria slows economic growth in Africa by up to 1.3% each year. This slowdown in economic growth due to malaria is over and above the more readily observed short run costs of the disease. Since sub-Saharan Africa's GDP is around $300 billion, the short-term benefits of malaria control can reasonably be estimated at between $3 billion and $12 billion per year.

In the 2010 National Malaria Indicator Survey report the government declared that Nigeria loses about N132 bn yearly to the disease. The amount is incurred through treatment cost, prevention and loss of man-hours. The disease contributes up to 33 per cent of all childhood deaths and about 300,000 lives are lost each year. Malaria affects 70 per cent of pregnant women and is responsible for 11 per cent of maternal mortality[30].

Reductions in malaria-related morbidity and mortality are feasible if affordable, effective and accessible complementary therapies and mosquito larvicides are used to complement the prevention and case management strategies for malaria control[31]. Trees planted can also serve as biocides for parasites which cause harmful diseases such as Malaria. This can contribute to the government's goal of reducing the incidence of malaria among pregnant women from the current 70% to 30%.

Examples of such trees include:
*Azadirachta Indica (*popularly known as Neem tree or Dogonyaro in the native Hausa language) has been shown to be effective in a number of ways against malaria. Both water and alcohol based neem leaf extracts have been confirmed as effective. It has been shown to block the development of the gamete in an infected person, even against the more virulent strains of the malaria parasite.
Other species are:

- *Morinda lucida*
- *Enantia chlorantha*
- *Alstonia boonei*
- *Khaya grandifoliola*

Waste collection for a healthier environment

Every community, village and state can have a waste management collection and disposal system to help improve the living conditions of community members by reducing the spread of infectious diseases which promotes a healthier lifestyle, the waste can then be converted into organic

[30] **Punch Newspapers**, 'Nigeria loses ₦132 bn annually to Malaria- Minister', 2012 http://www.punchng.com/news/nigeria-loses-n132bn-annually-to-malaria-minister
[31] Niyi Awofeso Neem tree extract *Azadirachta indica* and malaria control in Africa and Asia: prospects and challenges, Scopemed Journal Management System, Spatula DD. 2011; 1(3): 167-174 http://www.scopemed.org/?mno=9334

fertiliser or energy, thus linking improved environmental health with increased production and utilisation of organic fertiliser and thus sustainable agricultural practises.

3 LESSONS LEARNED – What Jigawa should take away

Climate change can seriously affect the outcomes of development initiatives, and in some cases even negate their benefits. Adaptation to climate change has yet to become a major policy factor within Nigeria, notwithstanding the fact that she is increasingly vulnerable to the adverse impacts of climate change. By viewing development through a climate change lens, appropriate steps can be taken to decrease vulnerability, and ensure that projects or programmes progress in a way that pays due consideration to the implications of environmental change.

3.1 Conclusions

- Ample entry points and opportunities for mainstreaming climate change into development exist in Jigawa State;
- Data which will steer climate proofing of developmental plans are not readily available and have to be extrapolated which requires added time and effort;
- It is possible for Jigawa State to do more (development-wise) with what they have (resource-wise);
- Trust of stakeholders within Jigawa will have to be earned for efforts at ensuring increased mainstreaming of climate change adaptation into development planning to be successful;
- All relevant stakeholders need to be involved, but their information needs may vary. Information must therefore be suited to the stakeholder group being engaged.

3.2 What Jigawa should take away

This study raises a number of issues facing development planners in Northern Nigeria where factors such as further desertification, droughts, occasional flooding, water shortages, increased diseases and associated social disruptions are starting to form a vicious cycle of economic degradation and social conflicts. Achieving developmental objectives in this context is especially difficult and requires that **development plans be carefully designed to take into account not only the adverse effects of climate change, but also the effects of the developmental (or growth) process on the environment, people as well as resources**.

The study aimed to show stakeholders in Jigawa that it is possible to do more with the little they have. Climate aware developmental planning is a good way of creating jobs and rebuilding economic activity amongst many groups. In fact, this approach helps to deepen value chains in that many more service providers can be integrated into economic activity to keep especially the youth occupied and earning. In this (alternative) approach, environmental policies and climate change mitigation and adaptation strategies are well-integrated into developmental programmes and projects, rather than executed as stand-alone. This integrated approach to sustainable development planning in climate constrained societies can potentially result in substantial budgetary savings, and tells a good political story which can certainly be built on by political office holders.

Cleaner (greener) alternatives that appear expensive in the short-term are indeed cheaper in the medium to long term and lead to significant financial savings. This is especially true in the areas

of Agriculture, Irrigation, Energy and Environment. In some cases, the economic benefits are rather substantial: for example, investment in solar powered irrigation pumps could have saved Jigawa State N 12 billion over ten years; focusing on organic fertiliser rather than heavy investment into chemical fertiliser would have created 500 jobs and saved N 8.25 billion.

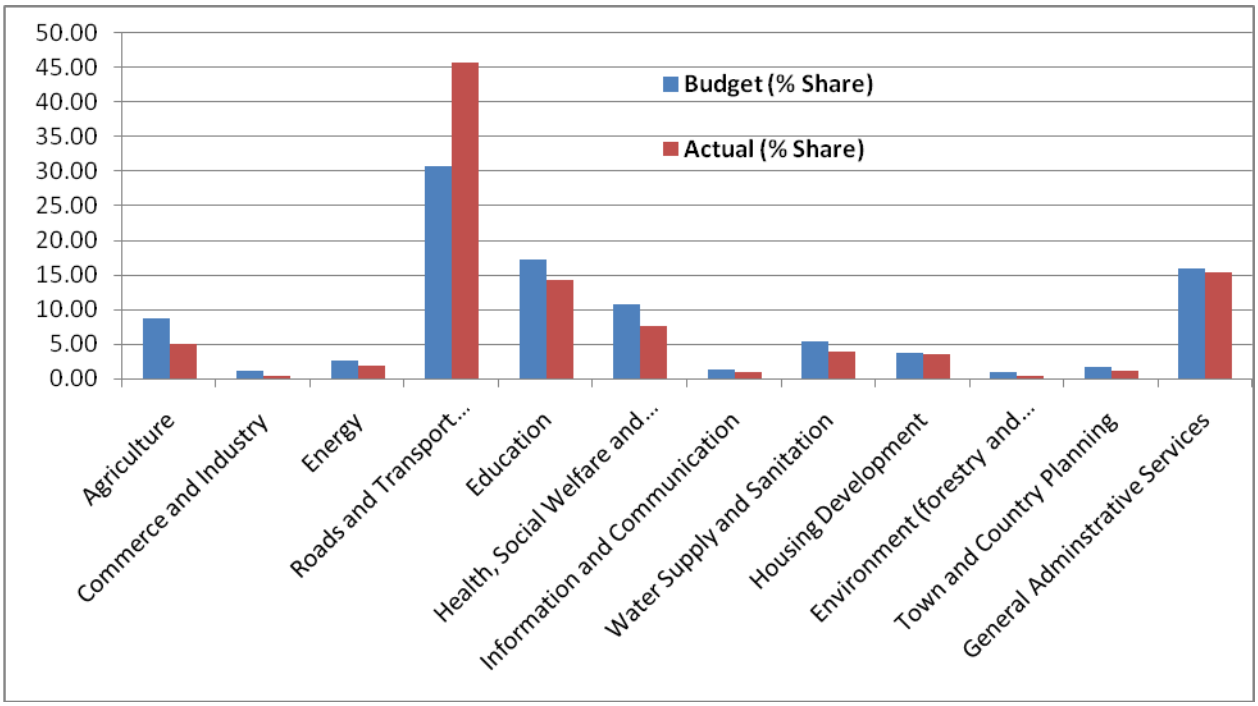
Under Energy, the study demonstrated how the State's development goal of providing at least 30% of households in the state with electricity could be achieved ahead of the deadline of 2020 by introducing small-scale biogas systems. In addition, this alternative would have saved the State over N 860 million over the duration of the 3-year Comprehensive Development Plan. This excludes other benefits such as jobs creation and the emergence of new markets and economic activities within the State.

Under Environment, the alternative budget demonstrates that slowing down the rate of desert encroachment and recovering the affected land would be achieved more efficiently when people and communities, rather than government are encouraged and empowered to own and lead the process. Drawing from the success of this approach in Niger Republic, this study argues that high and recurrent cost for annual tree planting and maintenance could be reduced if not eliminated completely.

On a final note, it has to be reiterated that climate-proof planning does not require new investments but a new thinking – not new capacities but joint approaches to planning.

4 ANNEX

4.1 Figure: Summary of Jigawa State's Planned and Actual Capital spending in 2010 Budget (Allocation in %)



4.2 Table: Summary of Jigawa State Approved Capital Budget for 2010

See separate file, fit into A4 size, portrait,
To be inserted on this page.

4.3. Table: Details of the 2010 Capital Budget

Fit the following table in Calibri 11, Portrait format and make intelligent page breaks

		Implementing Agency	Budgeted	% of Budget	Actual	% of Actual	Actual as % of Budgeted (level of Implementation

Total Capital Expenditure			**41,859,800,000.00**	**% of Budget**	**36,429,211,208.00**	**% of Actual**	**Actual as % of Budgeted (level of Implementation**
Agriculture	Agriculture and Livestock Development		***3,629,800,000.00***	***8.671***	***1,852,063,168.00***	***5.084***	**51.02**
	Field Crop&Termite control	Min of Agric	60,000,000.00	*1.653*	26,981,875.00	*1.457*	**44.97**
	Tree Corps and Horticulture	Min of Agric	2,000,000.00	*0.055*		*0.000*	**0.00**
	Fertiliser Procurement, Transport and Handling	Min of Agric	1,000,000,000.00	*27.550*	934,749,124.00	*50.471*	**93.47**
	Central Workhop and Farm Centre	Min of Agric	3,000,000.00	*0.083*		*0.000*	**0.00**
	Integrated Agriculture & Rural Development Programme (State ADP)	JARDA	991,000,000.00	*27.302*	107,799,309.00	*5.820*	**10.88**
	Jigawa State Agricultureal Research Institute (JRI)	JIR	55,000,000.00	*1.515*	6,750,785.00	*0.365*	**12.27**
	Purchase of Grains for Buffer Stock	Min of Agric	100,000,000.00	*2.755*	48,508,500.00	*2.619*	**48.51**
	Crop Rehabilitation Programme	Min of Agric	30,000,000.00	*0.826*	17,715,990.00	*0.957*	**59.05**
	Agricultural	Min of	112,000,00	*3.08*	15,046,49	*0.812*	**13.43**

	Mechanisation Programme	Agric	0.00	*6*	9.00		
	National Food Security Programme	JARDA	135,500,000.00	*3.733*	0.00	*0.000*	**0.00**
	Veterinary Clinics	Min of Agric	40,000,000.00	*1.102*	6,768,423.00	*0.365*	**16.92**
	Veterinary Mobile Clinics	Min of Agric	7,500,000.00	*0.207*	0.00	*0.000*	**0.00**
	Disease control and Eradication Programmes	Min of Agric	10,000,000.00	*0.275*	9,133,758.00	*0.493*	**91.34**
	Hide and Skin Quality Improvement	Min of Agric	10,000,000.00	*0.275*	6,821,141.00	*0.368*	**68.21**
	Development of Farm Settlement and Grasing Reserves	Min of Agric	30,000,000.00	*0.826*	14,850,000.00	*0.802*	**49.50**
	Fodder Conservtion	Min of Agric	5,000,000.00	*0.138*	0.00	*0.000*	**0.00**
	Iinvestock Investigation and Breeding Centres	Min of Agric	20,000,000.00	*0.551*	0.00	*0.000*	**0.00**
	Sheep and Goat Ranches (Birniwa and Kazaure)	Min of Agric	5,000,000.00	*0.138*	0.00	*0.000*	**0.00**
	Fish Seedling and Multiplication	Min of Agric	8,800,000.00	*0.242*	0.00	*0.000*	**0.00**
	Artisanal Fisheries Development	Min of Agric	5,000,000.00	*0.138*	837,500.00	*0.045*	**16.75**
	poverty alleviation	Dir of Econ Empowerment	880,000,000.00	*24.244*	653,570,264.00	*35.289*	**74.27**

Irrigation	**Surface Water, Fadama and Borehole-based Irrigation Schemes**	**Min of Agric**	**120,000,000.00**	**3.306**	**2,530,000.00**	**0.137**	**2.11**
Energy			**1,120,000,000.00**	***2.676***	**641,280,342.00**	**1.760**	**57.26**
	New Rural Electrification Projects	REB	750,000,000.00	***66.964***	357,313,843.00	**55.719**	**47.64**
	Complettion of Ongoing State Rural Electrification Projects	REB	150,000,000.00	***13.393***	147,149,048.00	**22.946**	**98.10**
	Maitainance (Upgrading) of Existing Rural Electrification Projects	REB	50,000,000.00	***4.464***	16,797,462.00	**2.619**	**33.59**
	Purcase of Project vehicles Plant and Equipment	REB	26,000,000.00	***2.321***	25,588,753.00	**3.990**	**98.42**
	Development of Integrated Platforms and Other Sources Of Power Generation	REB	50,000,000.00	***4.464***	2,330,000.00	**0.363**	**4.66**
	Development of Alternative Energy Source (bio-mass and Solar)	Alternative Energy	94,000,000.00	***8.393***	92,101,236.00	**14.362**	**97.98**
Water Supply and Sanitatio			**2,230,000,000.00**	**5.33**	**1,392,193,988.00**	**3.822**	**62.43**

n							
	Repurbishing and Purchase of Utility Vehicles	RUWASA	10,000,000.00	***0.448***		0.000	0.00

	installation of Mechanical Equipment	RUWASA	8,000,000.00	***0.359***		0.000	0.00
	Rural Water Supply and Sanitation Projects	RUWASA	425,000,000.00	***19.058***	257,216,642.00	18.476	60.52
	Water Supply to New Layouts and Low Cost Housing Estates	Water Board	50,000,000.00	***2.242***	47,089,037.00	3.382	94.18
	Power Connection to Water Supply Schemes	STOWA	5,000,000.00	***0.224***	4,389,849.00	0.315	87.80
	Dutse Water Supply Scheme	Min of Water Resources	430,000,000.00	***19.283***	226,922,824.00	16.300	52.77
	Rehabilitation of Existing Dams	Min of Water Resources	100,000,000.00	***4.484***	26,274,552.00	1.887	26.27
	Repurbishing and Purchase of Utility Vehicles	Min of Water Resources	6,000,000.00	***0.269***	5,961,025.00	0.428	99.35
	Hydro-metrological Stations	Min of Water Resources	3,000,000.00	***0.135***	2,882,700.00	0.207	96.09
	Purchase of Drilling Rigs and Accessories	Min of Water Resources	35,000,000.00	***1.570***	35,000,000.00	2.514	100.00
	Feasibility Studies	Min of Water Resources	5,000,000.00	***0.224***	0.00	0.000	0.00

	WSSPR Supported Water Projects	Min of Water Resources	400,000,000.00	***17.937***	23,295,758.00	1.673	5.82
	Shuwarin Water Supply Scheme	Water Board	65,000,000.00	***2.915***	95,419,815.00	6.854	146.80
	Improvement of Water Supply Scheme in Local Government Headquarters	Water Board	20,000,000.00	***0.897***	19,040,594.00	1.368	95.20
	Rehabilitation of Existing Water Supply Scheme	Water Board	60,000,000.00	***2.691***	59,947,143.00	4.306	99.91
	Repurbishing and Purchase of Utility Vehicles	Water Board	6,000,000.00	***0.269***	6,000,000.00	0.431	100.00
	Water Supply Laboratory	Water Board	2,000,000.00	***0.090***	0.00	0.000	0.00
	Rehabilitation and additonal Borehole to Existing Water Supply Schemes	Water Board	95,000,000.00	***4.260***	93,673,828.00	6.729	98.60
	Rehabilitation of Existing Water Supply Scheme	STOWA	50,000,000.00	***2.242***	47,850,781.00	3.437	95.70
	Reinforcement of Trunk Mains and Maintenance of Reticulation	STOWA	10,000,000.00	***0.448***	4,439,711.00	0.319	44.40
	Establishment of New Motorised Water Schemes in Small Towns	STOWA	130,000,000.00	***5.830***	193,046,028.00	13.866	148.50
	Installation of	STOWA	310,000,00	***13.9***	238,841,7	17.156	77.05

	Solar Based Power Plants		0.00	***01***	75.00		
	Asset Inventory	STOWA	5,000,000.00	***0.224***	4,901,926.00	0.352	98.04
Environment (forestry and Sewage)			**370,000,000.00**	**0.88**	**152,945,512.00**	**0.420**	**41.34**
	Forest Nurseries Development and production of Seedling	Min of Environment	30,000,000.00	8.11	16,676,500.00	10.904	55.59
	Forest Shelterbelt and natural Forest Reserve Development	Min of Environment	40,000,000.00	10.81	20,616,872.00	13.480	51.54
	Forest Extension and Mass Mobilisation Programme (tree Planting Campaign)	Min of Environment	4,000,000.00	1.08		0.000	0.00
	Development of Industrial Gum Arabic	Min of Environment	3,000,000.00	0.81		0.000	0.00
	Natural Lakes Consevation	Min of Environment	4,000,000.00	1.08		0.000	0.00
	Environmental Research and Database Development	Min of Environment	4,000,000.00	1.08		0.000	0.00
	Nature Conservation Programme	Min of Environment	20,000,000.00	5.41	4,978,000.00	3.255	24.89

	Flood and Erosion Contral Projects	Min of Environment	120,000,000.00	32.43	58,397,692.00	38.182	48.66
	Flood and Erosion Contral Projects Maintainace	JISEP	75,000,000.00	20.27	47,338,346.00	30.951	63.12
	Second Forestry Projec (World Bank Assisted) Jigap	JIGAP	10,000,000.00	2.70		0.000	0.00
	Parks and Gardens for the State Capital	DCDA	10,000,000.00	2.70		0.000	0.00
	Dutse Erosion Control	DCDA	50,000,000.00	13.51	4,938,102.00	3.229	9.88

4.4 Facts about irrigation pumps

Fuel powered pumps	Solar powered pumps
• Uses 1 gallon of fuel per day	• Direct current pumps do not need a battery, as the solar panel powers the pump until the tap is closed, or the tank is full
• Emits CO2, carbon monoxide, nitrogen oxides	• Zero emissions
• Lower initial purchase cost	• Higher initial purchase cost
• Permanent costs of maintenance	• Low or zero maintenance if correctly installed

Due to the imperfections inherent in all internal combustion engines, when gasoline is burnt, the following are produced:

a. CO_2 (Carbon IV Oxide)
b. H_20 (Water)
c. CO (Carbon mono Oxide)
d. NO_x (Nitrogen Oxides)
e. VOCs (Volatile organic compounds which are hydrocarbons left unburnt).

The following calculated estimation is a comparison between a gasoline and solar powered 1hp water pump.

Costs of fuel pumps

Capital cost of 1 hp gasoline water pump: **₦52, 000** ($325)

The current international market price of carbon averages €7 per tonne, amounting to ₦1435 (at current exchange rates), and 1 gallon of gasoline produces approximately 8.91 kg of CO_2 which equals 0.00891 tonnes.

The environmental cost of utilising 1 gallon of gasoline can therefore be calculated as thus:
Cost of 1 tonne of carbon (in ₦) × tonnes of carbon emitted by 1 gallon of gasoline
= ₦1435 × 0.00891 tonnes
= **₦ 12.78 per gallon of gasoline utilized.**

Cost of diesel generator driven irrigation systems

A typical irrigation scheme will have a lifespan of ± 25 years, but for the essence of this study, and to calculate returns on investment within a reasonable amount of time, we will make use of 10 years. The environmental costs of running the gasoline pumps everyday for 10 years using 1 gallon of gasoline can therefore be inferred as:
(12.78*10*365) = **₦ 46,647**

The cost of fuel per day (at the prevailing official rate of ₦97)
= ₦ (4* 97)
= **₦ 388**
The cost of gasoline for **10 years** per pump can be deduced as:
Cost per day of gasoline × length of time used
= 388 × 10 × 365
= **₦ 1,416,200**
Capital costs: ₦52, 000 × 10,000 = **₦ 520,000,000**
Recurring costs
Fuel costs: ₦1,416,200 × 10,000 = **₦14,162,000,000**
Environmental costs: ₦46, 647 × 10,000 = **₦ 466,470,000**
Total costs (inclusive of capital and recurrent) = ₦15,148,470,000
We can compare the above cost with the cost of procuring and maintaining solar pumps to drive the promotion of irrigation agriculture.

Costs of acquiring Solar Water Pumps
From the different suppliers and online trade platforms, a DC submersible solar pump ranges from between $300- 2000 depending on quality.
We can therefore calculate the cost of a 1hp solar water pump in naira as:
Cost of 1hp × Prevailing exchange rate
= ($2000) × 160
= ₦320,000
Costs for 10,000 water pumps will therefore be equal to **₦3, 200,000,000**
The Solar water pump is a cleaner alternative to fossil fuel driven engines both as an advantage to the environment as well as a community with budgetary and conditional constraints. Other benefits include:

- Energy efficient (no fuel costs either)
- Cost efficient to operate
- Produces water when it is needed most – during the hot and dry months
- Operates using solar panels, DC power sources
- Low maintenance (unattended operation)
- Can operate with or without battery backup storage capacity

Therefore, we can already see that comparing over this **10 year** period, Jigawa state can save up to **₦11,948,470,000**.

4.5 Cost Benefit Analysis of Organic fertiliser vs Inorganic Fertiliser

Investments & Running Expenditures

In order to put the monetary benefits of the transition into proper context, it is essential to do a cost benefit analysis of the two options.
50kg (0.05Mt) bag of chemical fertiliser averages about ₦6,000. Converting this sum to metric tonnes, we can deduce that 1Mt of fertiliser will cost ₦ 120,000. The total amount of fertiliser in metric tonnes that can be procured with the amount of money budgeted and released within 2010 Jigawa budgetary provision is approximately 7000 Metric tonnes (factoring in transportation, handling & logistics).
In the event that the Jigawa state government decided to establish an organic fertiliser production plant, how much would it cost? The calculations below give a hypothetical calculation based on information gathered from Monroe Works, an organic fertiliser production company based in California.

- Establishment of an Organic Fertiliser production plant (one-off investment) at $3Million (₦750million)
- Production Capacity is about (10,000 – 15,000) Metric tonnes per Year

The components of organic fertiliser include: biodegradable waste (Human excreta, food waste, animal waste, dolomite, rock phosphate, leaves etc)

Jigawa State has a population of about 5million with an estimated waste generated of about 1.5Metric tonnes a year/household (i.e. if 200,000 households generate 1.5metric tonnes/yr = 300,000 metric tonnes of organic waste)
3 Metric tonnes of Waste can produce 1 Metric tonnes of Organic fertiliser
If Jigawa state generates an estimated 30,000Metric tonnes of waste, the production line can produce about 10,000Metric tonnes of Organic fertiliser

Labour Costs for the recurrent part of the project i.e. cost of waste collection and transfer to production plant using unemployed youths can be calculated, factored in and budgeted for as part of provision for job creation, thus reducing the amounts required to alleviate poverty.

The Organic Fertiliser Plant and its Potential for Job Creation

From statistics, 0.48 MT/Person /Year of waste is produced by a average human being
The quantity of waste produced per person per day will therefore be (0.48/365)
= 0.00132Metric Tonnes/Person/Day
0.00132 × 4 (assuming we have 4 members per household) = 0.0053MT/House/Day
Assuming 1 person goes round 30 households per day
30 households = 0.0053 × 30
1 waste collector collects 0.16MT/day of waste.
To produce 1 MT of organic fertiliser, we require 3MTs of waste.

To compare with the amount of inorganic fertiliser procured per budget year, we assume the factory would produce 10,000MT of organic fertiliser per year.
To produce 10,000MT of organic fertiliser, we would require 30,000MT of waste.
From our calculations above, we determined that 1 collector going to 30 households can collect 0.16MT per day.
1 collector therefore collects 0.16 × 365 MT/year = 58.4MT/year
To collect 30,000MT of waste per year, we require:
30,000/58.4 = 514 people.

Hence, waste collection can create 514 jobs to collect waste for the bio composter from 15.420 households to produce organic fertiliser for the whole of Jigawa.