Wood Energy

renewable, profitable, and modern

A collection of talking points for lobbyists

I. Seven key-advantages of wood-based fuels

II. Principal challenges

III. Success stories

gtz HERA Poverty-oriented basic energy services

On behalf of Federal Ministry for Economic Cooperation and Development

Wood Energy

renewable, profitable, and modern

Table of content

I. Key-advantages of wood-based fuels

1. **Wood energy is widely used and renewable**
2. **Sustainable wood production safeguards forest functions**
3. **Wood energy is locally available**
4. **Wood energy provides employment and income**
5. **Wood energy supports domestic economies**
6. **Wood energy is modern and leads to innovation**
7. **Wood energy makes a country independent of energy imports**

II. Principal challenges

1. **Political support is needed**
2. **Regulatory frameworks need adjusting**
3. **The technology gap needs closing**
4. **Modernization is needed across the entire value chain**

III. Success stories

1. **Biomass energy strategy – Rwanda**
2. **Individual reforestation scheme – Madagascar**
3. **Community forest management – Senegal**

Preface

For Millennia, wood energy was the sole source of energy for humankind, until it was augmented in the course of industrialization on a grand scale with fossil fuels and, in the recent past, with nuclear power. However, wood still remains the principal fuel in developing countries and, owing to mounting scarcity of fossil fuels and growing concerns over climate change, it has regained significance in many industrial countries. The increasing demand for wood energy, especially by urban consumers in developing countries, places heavy pressures on forest resources. Under-valuation of wood fuels translates into wasteful and inefficient production and consumption practices, and creates a formidable disincentive for forest management and tree cultivation.

Many developing countries' national policies and energy-sector programmes tend to consider wood-based fuel as a 'backward' and ecologically-risky energy source, and seek to discourage its use, and/or mitigate its prevalence. Consequently they seek to replace the so called 'traditional fuels' with 'modern fuels' as soon as possible.

Technological advancements over the last decades in the production and conversion of wood into both heat and electrical power have removed many of the barriers to the greater use of wood as a clean and renewable energy source. Renewed interest in wood energy is being driven largely by social, economic and environmental concerns –which are now being recognized and valued even in international processes and organisations.

Modernization of the wood energy value chain in developing countries needs to be matched with progressive policies to foster the potential of biomass for poverty alleviation and sustainable rural development. One vital condition for approaching sustainability in development is that wood resources and environmental services are not undervalued or underpriced; a condition frequently violated in practice. Appropriate incentives for sustainable forest management (SFM) by local wood energy producers, and the introduction of more efficient conversion and combustion technologies, would help maintain and even create new forest resources.

Key message to policymakers: Give wood energy a fair chance in the energy mix of your country so as to make the world a more sustainable and a more environmentally friendly place.

I. Key-advantages of wood-based fuels

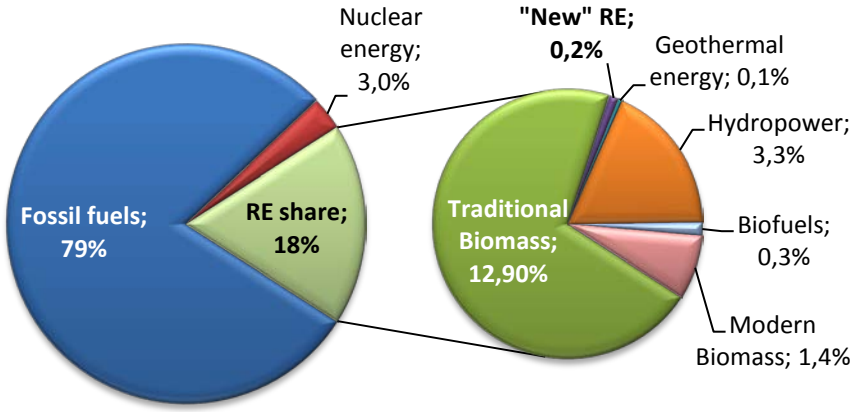
1. Wood energy is widely used and renewable
2. Sustainable wood production safeguards forest functions
3. Wood energy is locally available
4. Wood energy provides employment and income
5. Wood energy supports domestic economies
6. Wood energy is modern and leads to innovation
7. Wood energy makes a country independent of energy imports

1. Wood energy is widely used and renewable

(a) Wood is the most widespread renewable source of energy

- **Worldwide, renewable energy (RE) accounts for 18% of the global energy supply ; nearly 13% can be attributed to traditional biomass*.**
- **Wood energy accounts for more than 80% of household energy consumption in many developing countries (93% in Burundi, 93% in the Dominican Republic, 97% in Bhutan, 80% in Paraguay, 92% in Nepal)[8].**
- **Within the EU, wood accounts for 58% of energy from renewable sources (Germany 41%). Its share is currently increasing by 3.5% annually.**
- **About one half of the global round-wood production is used for fuel (1.8 billion m^3)[10].**
- **By 2030, roughly 2.7 billion people in developing countries will depend on wood-fuel for fuel.**

Structure of the global energy supply in 2006[11]



Projection of dependence on woodfuel (millions of people) to 2030 [9]

	2004	*2015*	*2030*
Sub-Saharan Africa	*575*	*627*	*720*
North Africa	*4*	*5*	*5*
India	*740*	*777*	*782*
China	*480*	*453*	*394*
Indonesia	*156*	*171*	*180*
Rest of Asia	*489*	*521*	*561*
Brazil	*23*	*26*	*27*
Rest of Latin America	*60*	*60*	*58*
Total	***2 528***	***2 640***	***2 727***

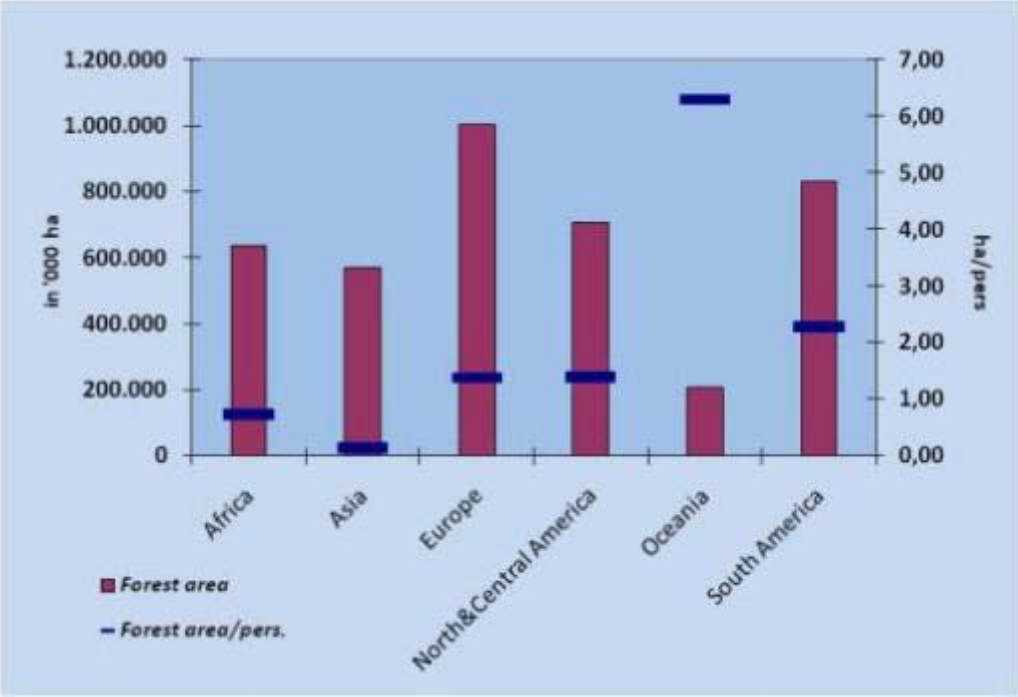
* Note that although wood energy *can* be a renewable energy resource, the management regimes in many countries prevent it from becoming sustainable. According to the FAO, 13 million hectares of forests are annually destroyed through human activities [2].

1. Wood energy is widely used and renewable

(b) Wood resources grow everywhere - within and outside forests

- **Nature produces about 170 billion tonnes of biomass annually, equivalent to 25 times the annual production of crude oil.**
- **Worldwide, forests cover about 4 billion hectares (40 million km²) or 30.3% of the total land area[2].**
- **According to a range of studies, the annual surplus wood supply* from forests is estimated between 0.3-1.4 billion m3 [12] compared to the current global demand of 1,8 billion m3.**
- **In Asia where the forest area per inhabitant ratio is low, trees grown outside forests (TOFs) account for upwards of 50 % of wood energy used[13]. Globally, a figure of 30 % can be assumed[14].**

Total forest area per region and per person [2]



* The differences in figures originate from different reduction factors applied to the global theoretical potential of the surplus wood supply by different authors. The reductions factors are determined by technical, economic and ecological considerations and can combined exceed 85% of the theoretical potential.

1. Wood energy is widely used and renewable

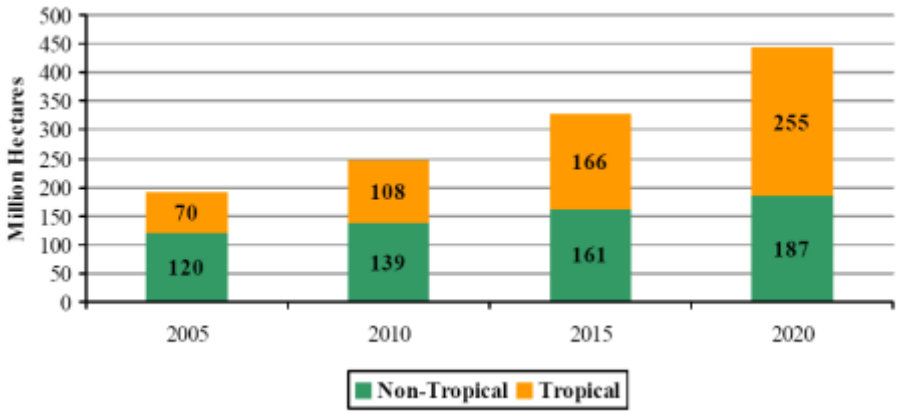
(c) There is an important dormant potential for wood production

- In developing countries, areas with potential for afforestation amount to 750 million hectare (= 7.5 million sq km)[15].
- Large tracts of suitable land are found in South America (46% of all the suitable areas globally) and Sub-Saharan Africa (27%).
- Use of this land could ensure sustainable energy supplies to more than 3 billion people annually.
- Each additional hectare of forest has a carbon mitigation potential by absorbing on average 10 tonnes of CO_2 annually[16].
- Afforestation on such a scale has the potential to offset the annual global increase in CO_2 and other GHGs [25].
- The importance of forest plantations will increase over time

Global map indicating suitable land with potential for afforestation and reforestation (AR) (dark green)[15]

* In recent years, the broader significance and importance of planted forests have been recognized internationally, and standards for their responsible management have been established, relating to social and environmental as well as economic benefits [4].

Estimated potential development of forest plantations [17]

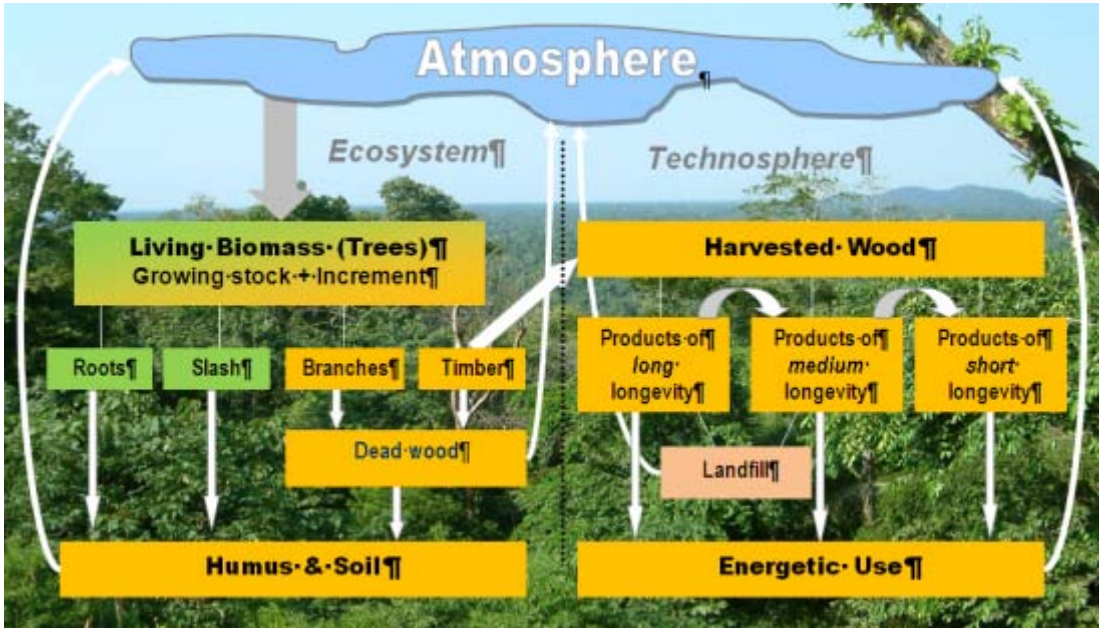


2. Sustainable wood production safeguards forest functions

(a) Sustainably sourced wood energy achieves carbon sequestration

- **Substituting fossil fuel with sustainably produced wood offsets 2-3 kilograms of CO_2 for each kilogram of fossil fuel.**
- **Consumption of sustainably sourced wood energy remains carbon-neutral. Burning wood releases no more CO2 than what was absorbed during a tree‘s life cycle. The same amount would be released through natural decay, if wood was left to rot in the forest.**
- **Wood-fuel is an environmentally friendly, low-risk energy carrier, with safe handling and storage, and short transport distances.**
- **Sustainably sourced wood-fuel can be promoted through carbon funding instruments.**

Forest biomass and wood products in the carbon cycle [18]



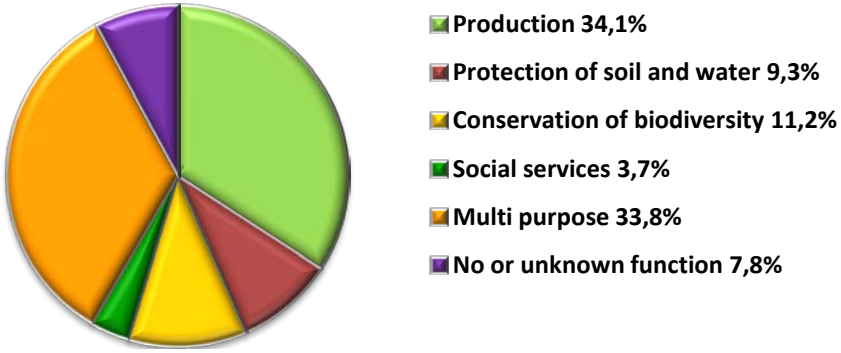
Deforestation accounts for up to 20 percent of the global greenhouse gas emissions that contribute to global warming.

2. Sustainable wood production safeguards forest functions

(b) Wood fuel production safeguards forest resources and promotes multiple uses

- **Woodfuel production creates an incentive for sustainable forest management (SFM). In many cases, the use of wood for energy can provide the economic basis for maintaining land in forests.**
- **Sustainably managed forests provide added value:**
  - **Soil protection**: Forests protect soils against erosion, prevent floods through enhanced water retention, lock-up large quantities of carbon in rich and intact forest soils, and generally enhance the structure and functional integrity of top-soil layers.
  - **Ecosystem support:** Micro-climatic benefits (protection against high winds, mitigation of extreme temperatures); provision of habitats for wild fauna and flora (conservation of biological diversity); cleansing of air and water, release of oxygen.

Designated functions of forests (natural and planted , globally, 2005[2]



3. Wood energy is locally available

- **Woodfuel is widely and locally available and ensures a secure and steady supply of energy, provided sustainable extraction is used.**
- **Wood is directly usable as fuel. Especially in urban situations wood may undergo further processing before being marketed as fuel*.**
- **Wood lends itself to being recycled following primary uses in construction, furniture or packaging. Wood residues from saw mills etc. likewise qualify as fuel.**
- **In contrast to solar energy and wind energy, which are available during limited times and therefore require energy storage systems, wood energy can be used on demand.****
- **Most countries have established markets for wood and wood-based fuels.**

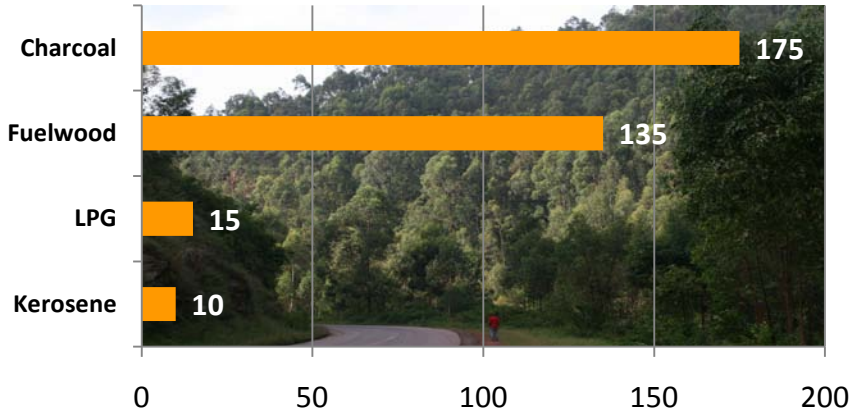
* The three most common forms of wood fuel besides firewood are charcoal, wood chips and wood briquettes or pellets.
** Wood is essentially a form of stored solar energy that is convenient to use.

4. Wood energy provides employment and income

- **Use of domestically produced and sustainably harvested wood for fuel creates *lasting demand* for regional goods and services.**
- **Regional production stimulates employment, especially in economically disadvantaged regions**
- **Production, transport and marketing of woodfuel *creates employment and income for th*e rural poor.**
- **Attempts to replace woodfuel with fossil fuels would reduce employment in energy supply.**

Examples of people involved in charcoal production and trade [20-22]

Estimated employment per 1 Tera-Joule energy consumed in person-days [19]



	Amount of charcoal produced (t)	Value Million USD/ year	Charcoal producer*	People involved in charcoal trade*
Country				
Kenya	1.600.000	400	200.000	500.000
Malawi	231.177	41	46.500	46.300
Urban areas				
Maputo	130.000	13	20.000	20.350
Dar es Salaam	440.000	44	54.000	71.200
Lusaka	250.000	25	37.000	40.700

*By including the dependants in each household, the amount of people being supported by the charcoal business can be at least quadrupled

5. Wood energy supports domestic economies

- **The total value of global woodfuel production is estimated to be in the range of US$4 billion to $26 billion per year[24]. These figures are likely to underestimate the true significance because wood-fuel production for the most part remains locked up in the informal sector.**
- **Wood-fuel production essentially is a localized business, one that boosts commerce especially in rural areas. By contrast, the use of fossil fuels drains 60-70 % of the money involved as foreign earnings. Wood energy purchase leads to 100 % of its value staying in the domestic economy, about half of which directly benefits rural producers.**
- **Wood-fuel prices are comparatively stable and easily predictable.**

Example Rwanda [1]:

Rwanda produces annually 150,000 T of charcoal with an estimated value of US$ 75 million. Some 50% of the value remains in rural areas.

***For comparison some macroeconomic figures on agricultural export and energy consumption*:**

- **Coffee export: $40 million**
- **Value electricity: $60 million**
- **Value LPG: $0.9 million**
- **Value kerosene : $34 million**

6. Wood energy is modern and leads to innovation

(a) Wood energy can be converted to other useable forms of energy

- **Wood is a energy carrier that can be converted to produce heat, electricity, transport fuel, or to manufacture products**

The energy content of wood can be released in two principal ways:

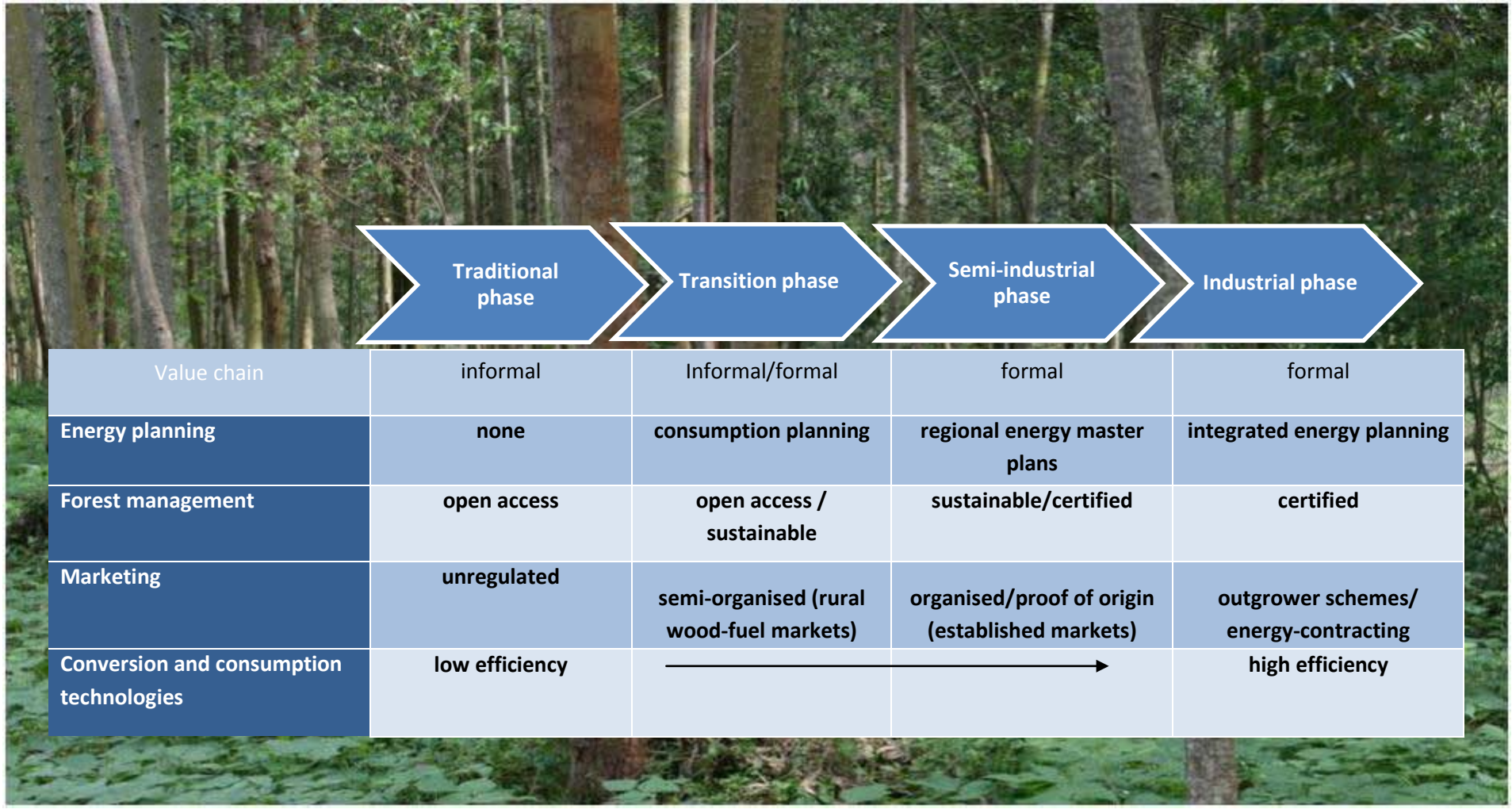
1. Direct combustion. Combustion is a thermo-chemical process in which wood is combined with oxygen and converted to carbon dioxide and water (and other constituents), releasing energy.

2. Gasification or pyrolysis. These are also thermo- chemical processes which convert wood into a gaseous or liquid fuel. The gaseous or liquid fuel is then combusted in a second step to release energy.

A biochemical process converts wood into ethanol, which can be used in vehicle engines for transport applications or for cooking.

6. Wood energy is modern and leads to innovation

(b) The wood energy value chain allows for stepwise development



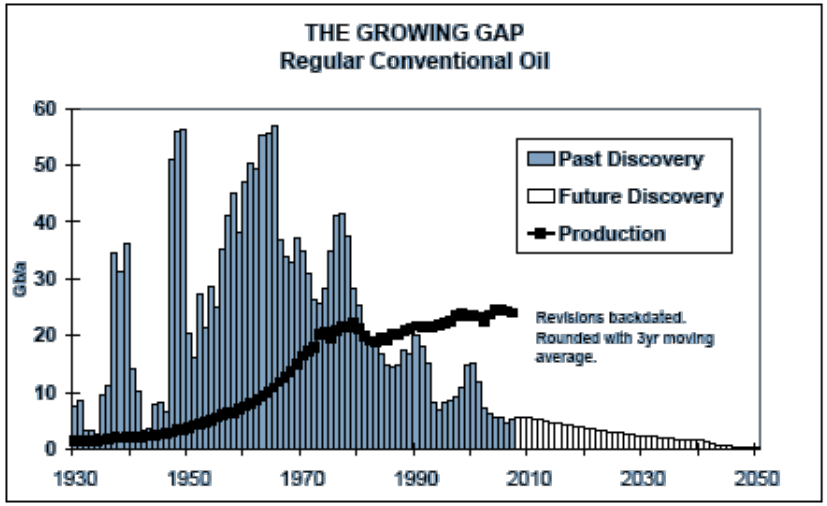
Value chain	informal	Informal/formal	formal	formal
Energy planning	**none**	**consumption planning**	**regional energy master plans**	**integrated energy planning**
Forest management	**open access**	**open access / sustainable**	**sustainable/certified**	**certified**
Marketing	**unregulated**	**semi-organised (rural wood-fuel markets)**	**organised/proof of origin (established markets)**	**outgrower schemes/ energy-contracting**
Conversion and consumption technologies	**low efficiency**	→	→	**high efficiency**

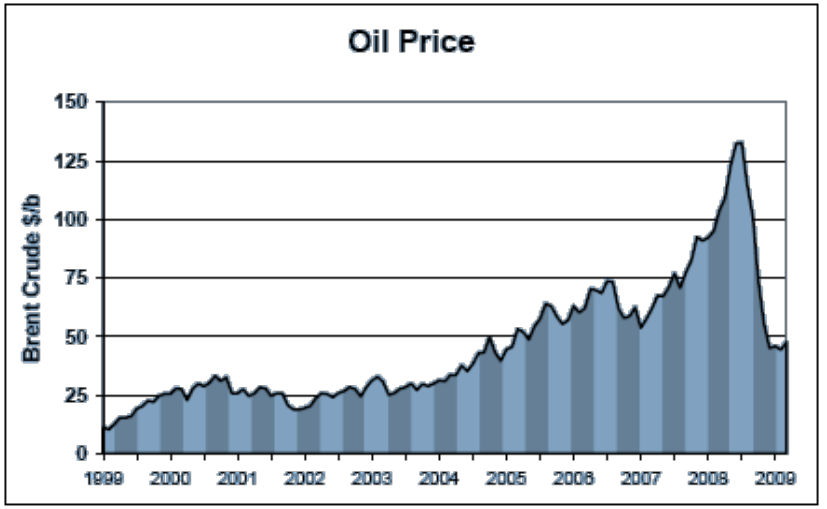
7. Wood energy makes independent of energy imports

- **Out of 47 of the world's poorest countries, 38 are net oil importers—the majority of them in Africa.**
- **Wood energy is a strategic option for increased energy security, particularly in countries that have large forest areas, or in areas amenable to reforestation and that depend on energy imports.**
  - **It makes communities independent of decreasing oil reserves**
  - **It makes people independent from international energy prices**
  - **It provides security in times of crises**
  - **It keeps energy dollars local to build strong rural economies**

The EU Green Paper 'Towards a European Strategy for the Security of Energy Supply' states that '*If no measures are taken, in the next 20 to 30 years 70% of the Union's energy requirements, as opposed to the current 50%, will be covered by imported products'[5].* Furthermore, the paper quotes '*…transport, the domestic sector and the electricity industry depend largely on oil and gas and are at the mercy of erratic variations in international prices'*. Wood, as an indigenous energy source, can contribute significantly to reducing import dependences and to improving trade balances.

Fossil oil is a finite resource subject to depletion and thus steadily increasing oil prices [23]





II. **Principal challenges**

1. Political support is needed
2. Regulatory frameworks need adjusting
3. The technology gap needs closing
4. Modernization is needed across the entire value chain

1. Political support is needed

(a) Developing countries' energy policies must reflect political commitment

Problems

(1) Most partner developing countries' energy policies are focused on electrification, whilst wood energy is ignored, discriminated against, or down-played. National budgets bear witness to this fact.

(2) Baseline data on wood energy demand and supply, as well as on wood energy value-chains, are outdated or simply lacking.

(3) Inter-sectoral policy coherence is often unsatisfactory.

Action required

Targeted support to create more enabling framework conditions, including regulatory frameworks, better informational basis, strategy development

Impact

- Informed policy decision making
- Integration of wood energy into forest and energy policies and strategies
- Public services and supporting agencies operating in line with clearcut policy guidance and coherent normative frameworks

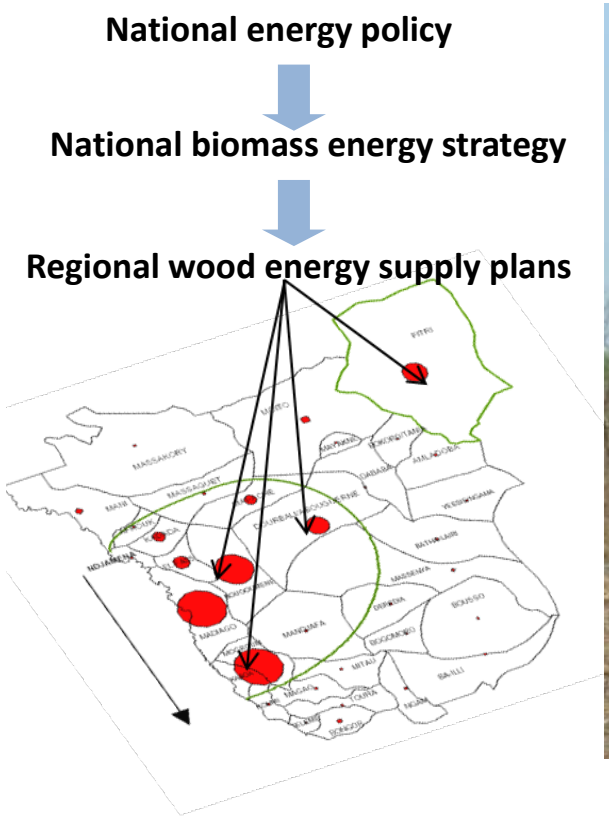
1. Political support is needed

(b) Energy policies need to be put into operation through strategies, and implemented through to local level

- ***Energy policies*** **address challenges and set goals for change and should include biomass as part of the future energy mix**

- ***Biomass energy strategies*** **analyse the different options on how to reach the goal; they propose the appropriate intervention lines and set out concrete actions by which the goals will be achieved[6].**

- ***Regional wood energy supply plans*** **are concerted regional planning tools, enabling planners to identify priority production zones and to put in place adequate framework conditions for sustainable forest management with the aim of providing a sustainable supply of fuel for the population.**



2. Regulatory frameworks needs adjusting
(a) Wood energy requires realistic market prices

Problems

- **Market prices currently do not reflect the cost of (sustainable) production.**
- **Unregulated use of wood energy is not controlled, preventing any attempt at sustainable forest management.**
- **Efficient conversion technologies and energy-efficient appliances are not used.**
- **Fuel substitution often fails and thus requirer high, continuous subsidies.**

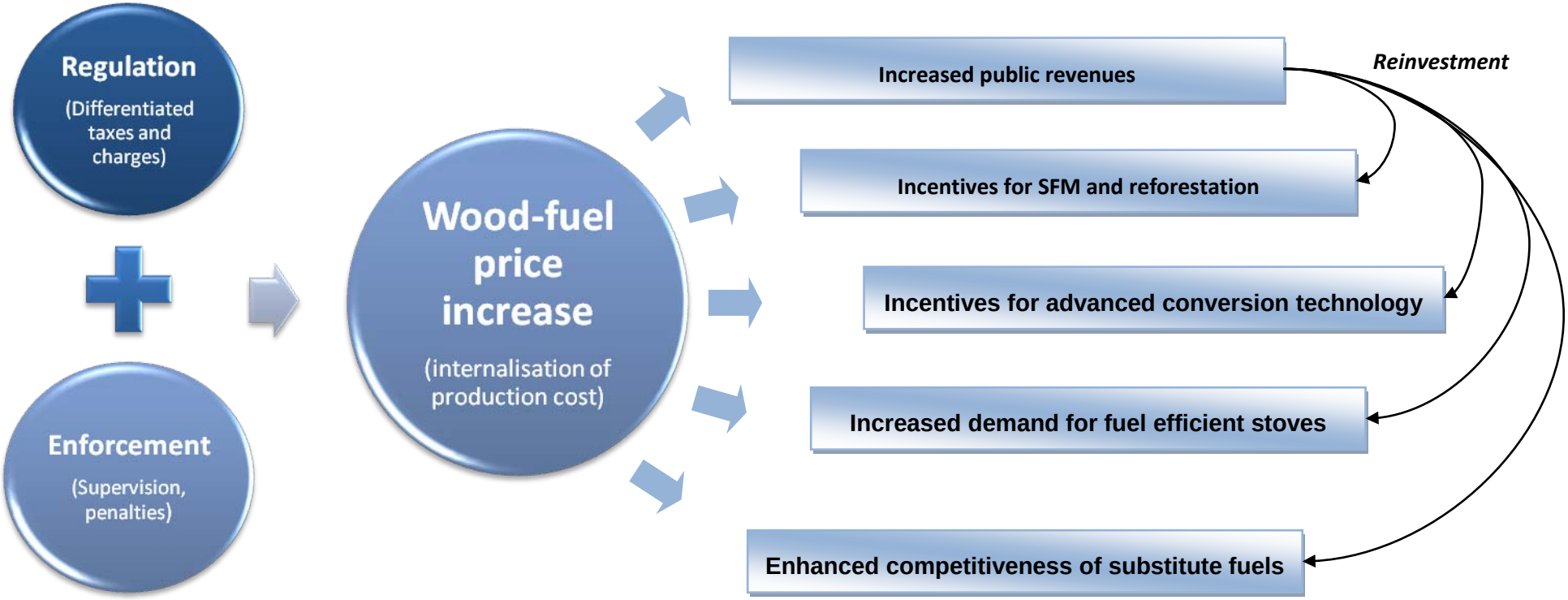
Action required

Support to economic policy measures (differentiated taxes and charges) and enhanced enforcement

Impact

- ❖ **The willingness of rural populations to invest in forestry production is strengthened**
- ❖ **Wood is used more efficiently**
- ❖ **Substitute fuels gain in competitiveness**

2. Regulatory frameworks needs adjusting
(b) Sustainable wood energy supplies require regulation and enforcement



The effect of a differentiated taxation is to penalize uncontrolled forest exploitation of free access areas, whilst rewarding sustainable forest management activities.

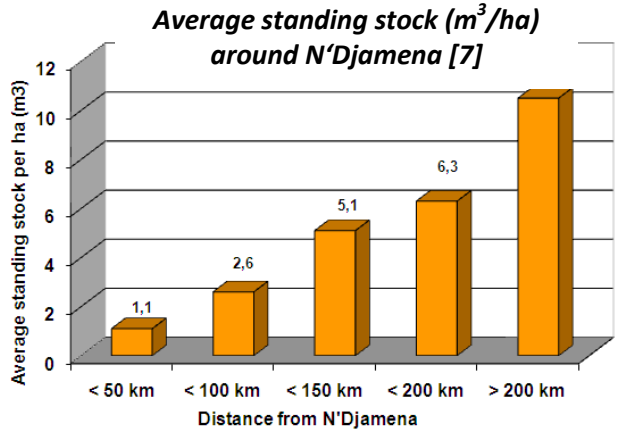
3. The technology gap needs closing
(a) Conversion technologies e.g. carbonization

Problem High demand, non-sustainable biomass use and inefficient conversion technologies are to blame for 10-20% of deforestation occurring around urban centres

Action required Expansion in use of improved appliances (e.g.

Impact

- increased revenues
- decreased wood consumption and resultant CO_2 emissions
- decrease in loss of forest cover



Traditional Phase → Transition-Phase → Semi-industrial Phase → Industrial Phase




- *Environmentally friendly*
- *Reduces health risks*
- *Economically viable*
- *Available*

3. The technology gap needs closing
(b) End-user technologies

Problems

- **Inefficient combustion causes high levels of indoor air pollution, and increases significantly the risk of respiratory illness (acute lower respiratory infections - ALRI, chronic obstructive pulmonary disease – COPD).**
- **Inefficient consumption increases the demand for wood-fuel and impairs sustainable wood-fuel supplies.**

Action required → **Promotion and dissemination of improved stoves**

Impact

- **reduced health hazards**
- **reduced spending on fuel**
- **lower CO_2 emissions**
- **reduced deforestation**

Traditional Phase → Transition-Phase → Semi-industrial Phase → Industrial Phase




- ***Environmentally friendly***
- ***Reduced health risks***
- ***Economic***
- ***Available***

4. Modernization is needed across the entire value-chain

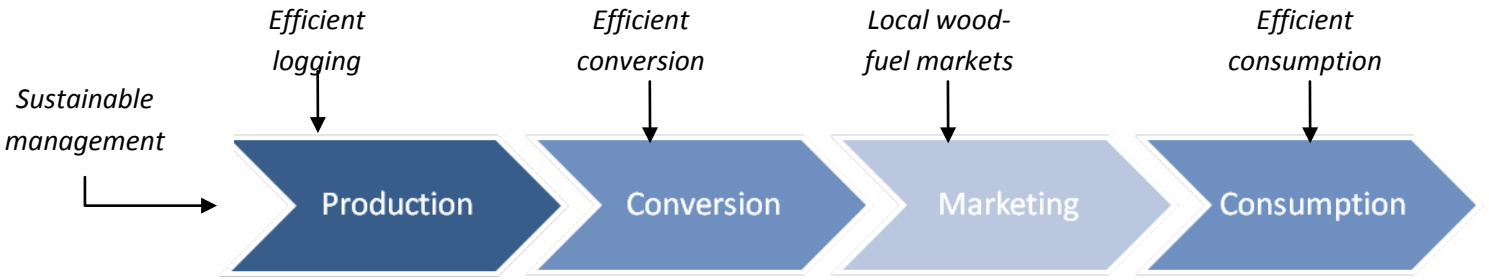
(a) Value chain approach

Problem — Isolated interventions (reforestation, sustainable forest management, dissemination of improved stoves) fail to exploit adequately possible synergies that would, if combined, make them sustainable

Action required — Targeted support to various stakeholder groups, to act as links in the entire value-chain

Impact

- ❖ increased value added on a regional scale
- ❖ improved efficiency of the entire value-chain
- ❖ sustainable provision of wood energy



4. Modernization is needed across the entire value-chain
(b) Improved leverage

- **Wood-fuel production:**
  - Devolution of secure, long-term tenure to rural communities (e.g. Niger, Mali, Tschad, Senegal, Madagascar)
  - Promotion of private plantations on marginal sites (e.g. Madagascar, Rwanda)
  - Energy contracting by small and medium-sized commercial consumers to private farmers (Brazil, Nicaragua)
- **Harvesting:**
  - User-group organisation
  - Optimisation of logging technology
  - Streamlining of logging and transport
  - Harmonising harvesting with consumption patterns
- **Conversion:**
  - Dissemination of improved technologies (e.g kilns)
  - Further research and development (efficiency, environmentally sound processes)
  - Introduction of alternative wood energy products (e.g. wood-chips, briquettes, or pellets)
- **Marketing**
  - Establishment of formalized local energy markets
  - Introduction & enforcement of a proof of origin for sustainably produced wood-fuel
  - Standardisation and improved product quality
  - More equitable benefit sharing
- **Consumption**
  - Dissemination of improved stoves
  - Research & development for cleaner and safer combustion
  - Streamlining wood-fuel products with consumption technologies
  - Kitchen management

III. **Success stories**

1. Biomass Energy Strategy Rwanda
2. Individual reforestation scheme Madagascar
3. Community forest management

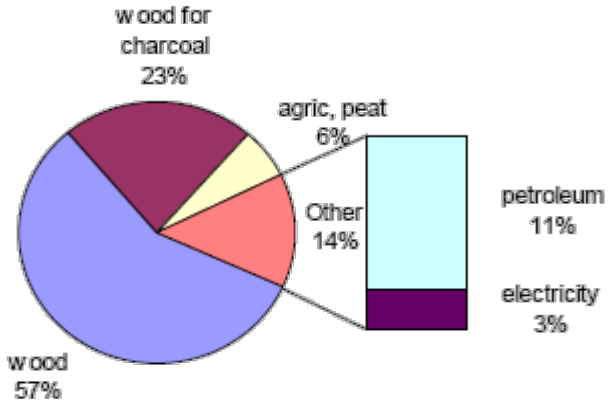
   Senegal

1. Biomass Energy Strategy (BEST) Rwanda

GTZ supported the Government of Rwanda between January and July 2008 to establish a Biomass Energy Strategy through a systematic and ongoing process comprising stakeholder consultation, and participation down to local level.

The following results have been obtained:

- **The initial demand and supply situation as well as impacts and causes were analysed**
- **Best practice scenarios were developed**
- **Vision and objectives of a biomass energy policy were defined**
- **Key interventions and provincial focal points were mutually identified**
- **An action plan including a funding strategy was developed**



2. Individual reforestation scheme Madagascar

Project design (duration: 1992-2010)

- **Afforestation limited to marginal land (opportunity costs=0)**
- **Voluntary decision of community members to participate**
- **Allocation of responsibilities to all community actors**
- **Individual ownership of plots and products (secured land/tenure rights)**
- **Capacity building, creation of rural energy markets**
- **Monitoring of plantation growth and quality**

Results (2010)

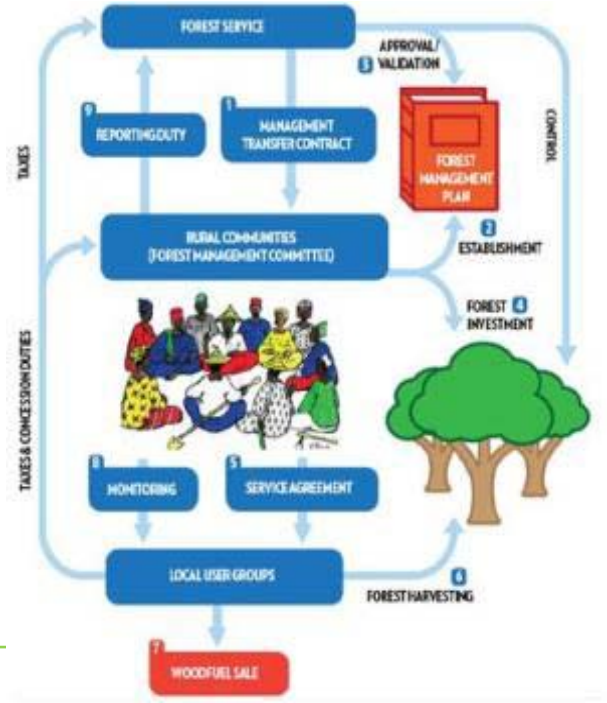
- ✓ **Afforestation area : 6,500 ha in 57 villages**
- ✓ **Involved households : 2000**
- ✓ **Share of the poorest : 34%**
- ✓ **Ownership of plots : 61% men; 22% women; 17% couples**
- ✓ **Average annual increase in income: 20%**
- ✓ **Value of the production /supply chain (5 rotations – 27 years): 9,900,000 Euros**
- ✓ **Sustainable supply to more than 80,000 urban woodfuel consumers**
- ✓ **Avoided deforestation of 49,000 ha of natural forests**
- ✓ **Reduction in fire incidents (social control): by 65%**

3. Community forest management Senegal

Project design (duration: 2003-2009)

- **Directives for sustainable management of state and community forests have been developed and endorsed**
- **A regional plan for the sustainable management of forests is available**
- **Capacity building has enabled local communities to enter partnership agreements with the forest services**
- **Production of management plans for eight forests (50,000 ha)**
- **Value chains for woodfuel and non-wood forest products have been enhanced**

Partnership between rural communities and forest service [3]



Results (2010)

Exemplified by the Sambande Community Forest (1,045 ha)

- ✓ **Eight villages with 2615 inhabitants are involved in sustainable forest management**
- ✓ **70 households can make a living from sustainable charcoal production**
- ✓ **Sustainable Forest Management now protects the species-rich Sambandé forest, preserves its ecosystem-functions, and avoids desertification**

References

1. GTZ/Marge, *Biomass Energy Strategy (BEST) Rwanda-Volume 2 -Background & Analysis*. 2008, GTZ: Eschborn.
2. FAO, *Global Forest Resources Assessment 2005 - Progress towards sustainable forest management*. Vol. FAO Forestry Paper 147. 2005, Rome: FAO.
3. de Miranda, R.C., et al., *Sustainable production of commercial woodfuel: Lessons and guidance from two strategies* 2010, Washington: ESMAP - The International Bank for Reconstruction and Development/THE WORLD BANK GROUP.
4. FAO, *Responsible management of planted forests - Voluntary guidelines*. Planted Forests and Trees Working Paper 37E. 2006, Rome: FAO.
5. European Commission, *Green Paper 'Towards a European Strategy for the Security of Energy Supply'*. (COM(2000) 769 final). 2000, Brussels.
6. GTZ, *Biomass Energy Strategy (BEST) - Guide for Policy Makers and Energy Planners* 2008, Eschborn: GTZ/EUEI Partnership Dialogue Facility (PDF)
7. Sepp, S. and S. Mann, *Ordnungspolitische Interventionen als Voraussetzung und Katalysator für nachhaltige Bereitstellung erneuerbarer Energie.* Holz-Zentralblatt, 2007(HZ-Nr. 34): p. 904-906.
8. FAO, *Interactive Wood Energy Statistics.* 2004, Rome: Food and Agriculture Organization.
9. IEA, *World Energy Outlook*. 2006, Paris: International Energy Agency / Organisation for Economic Co-operation and Development.
10. FAO. *Forests and Energy*. in *C2007/INF/17*. 2007. Rome.
11. BMU, *Erneuerbare Energien in Zahlen - Nationale und internationale Entwicklung*. 2009, Berlin, Germany: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU).
12. Mabee, W.E. and J.N. Saddler, *Forests and energy in OECD countries*. Forests and Energy Working Paper No.1. 2007, Rome: FAO.
13. FAO, *Trees Outside the Forest:Towards Rural and Urban Integrated Resources Management*, in *Working Paper*. 2001, Forestry Department: Rome.
14. Smeets, E.M.W. and A.P.C. Faaij, *Bioenergy Potentials from Forestry in 2050. An assessment of the drivers that determine the potentials.* Climatic Change, 2006. Volume 81, Numbers 3-4.
15. Zomer, R.J., et al., *Climate change mitigation: A spatial analysis of global land suitability for clean development mechanism afforestation and reforestation. .* Agriculture, Ecosystems and Environment 126, p 67-80, 2008.
16. Paul, C., M. Weber, and R. Mosandl, *Kohlenstoffbindung junger Aufforstungsflächen*. 2009, Freising: Karl Gayer Institut,Lehrstuhl für Waldbau der Technischen Universität München.
17. Tomaselli, I., *Global Wood and Products Flows -Trends and Perspectives-*. 2007, Shanghai-China: FAO/stcp.
18. Pistorius, T., *Untersuchungen zur Rolle des Waldes und der Forstwirtschaft im Kohlenstoffhaushalt des Landes Baden-Württemberg*. 2008, Freiburg: Institut für Forst- und Umweltpolitik.
19. RWEDP-FAO, *Regional Study on Wood Energy Today and Tomorrow in Asia.* Field Document-Regional Wood Energy Development Programme in Asia, 1997. No.50.
20. Mutimba, S. and M. Barasa, *National Charcoal Survey:Exploring the potential for a sustainable charcoal industry in Kenya*. 2005, Nairobi.
21. Kambewa, P.S.e.a., *Charcoal : The Reality, A study of charcoal consumption, trade and production in Malawi, Community Partnerships for Sustainable Resource Management in Malawi (COMPASS II)*. 2007.
22. Ministry of Water Lands and Environment, *The National Forest Plan*. 2002, Kampala, Uganda.
23. ASPO, *Newsletter 100*. 2009, Association for the study of peak oil and gas, http://www.energiekrise.de/e/aspo_news/aspo/Newsletter100.pdf: Cork, Ireland.
24. FAO, *State of the World's Forests 2005*, FAO Forestry Department, Rome.
25. Prima Klima: http://www.prima-klima-weltweit.de/grafiken/pdf/prima-klima-faustformel.pdf

Published by

Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH
- German Technical Cooperation -

Programme on Poverty oriented Basic Energy Services (HERA)

Postfach 5180
65726 Eschborn
T +49 61 96 79-0
F +49 61 96 79-11 15
E info@gtz.de
I http://www.gtz.de/hera

Responsible

Marlis Kees

Author

Steve Sepp, ECO Consulting Group

Editors

Verena Brinkmann, Lisa Feldmann

English text editing

Liz Bates

Photos

Cover: F. Richter (left), S. Sepp (right),
S. Sepp: p.7,p.8,p.9,p.10,p.11.p13,p.17,p.23,p.24,p.25,p.27
F. Richter: p.0,p.3,p.15,p.20
Pascal Lopez: p.12, p.26
C. Adam: p.20
GTZ: p.21
Firma Lohberger/ Kaufhaus Philipp Horn: p.21 (‘Rega’ Stove on the right)

Eschborn August 2010