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National Policies for Small Wind: The Case of Ethiopia

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1. **Introductory Background on Wind Regimes and the Objective of the National Policy Formulations on Small Wind Developments in Ethiopia**
 - ***A Profile of Ethiopia with an Overview of Low Disseminations of Renewable Energy Technologies (RETs) in the Country;***
 - **A land-locked country, Situated on the Horn of Africa, near the Red Sea; (see Annex 1); Population: 85-90 million -Rural: 82-85% ; Urban: 18-15%**
 - **Mountainous landscapes, , and hot plains with steady and variable climates and substantial wind distributions; Average Wind Speed $v \geq 3$ m/s;**
 - ***Windiness Experiences among Farmers in Ethiopia:***
 - **Traditional farmers in Ethiopia are used to follow and monitor weather conditions pertaining to rainy and drought seasons., and variations in windiness.**

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Key Notes:

- *Absences of Small-Scale Wind Power Development Issues and Themes* in Ethiopia , with low disseminations of Renewable Energy Technologies (RETs), also as in many other Sub-Saharan Africa (SSA) Countries ;
- *Existing Few Small Wind Power Plants for Water Pumping only, with donor-sponsored projects; no small-scale Wind Plants for Electricity Generation;*
- Still. Wind Power Generation for *Grid Integration* in Ethiopia advancing since 2009 , and heading soon towards *a total capacity of 324 MW with 8% penetration;* a useful mix for *a largely total Hydropower-based Power System with a Current 2,000 MW Power Capacity, and heading towards 8,000 MW to 10,000 MW by 2015-2018.*

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- **Brief Notes on Wind Systems for Disseminations and Installations in SSA countries, including the vast rural agricultural and pastoral areas of Ethiopia:**
 - Wind turbines with horizontal-axis of rotations, will need to be promoted and advanced for economic activities, subject to financial supports, as well as paces of technology and management; transfers;
 - As shown summarized in Tables 1–4, with small-scale wind plants, the key parameters and issues of direct interest for rapid developments are:
 1. Potential windy sites, with average wind speeds within areas of development;
 2. Diameters of wind turbine blades (in m), and swept areas (in square meters);
 3. Wind turbine structures (eg. with 3-, 4-, blades, and so on);
 4. Foundations and heights of mounting towers; basic system configurations and structures; potential lands/areas for rapid developments; availabilities of, and skills for wind turbine assemblies with key components;
 5. Estimates of wind power densities, and annual energy outputs;
 6. Preliminary cost estimates for installations, maintenance and repairs; and
 7. Economic activities and development prospects, patterns, or plans in windy sites.

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Table 1. Wind Speed, power density, of different classes
(Source: Habetzion, 2004)

Mean annual wind speed , m/s, at 10 m ht	Wind power density at 10 m ht in W/m²	Wind power class	Applications in each class
0 – 4.4	0 – 100	1	Small-scale power generation “ “ “ “ Large-scale power generation for grid integration “ “
4.4 – 5.1	100 – 150	2	
5.1 – 5.6	150 – 200	3	
5.6 – 6.0	200 – 250	4	
6.0 – 6.4	250 – 300	5	
6.4 – 7.0	300 – 400	6	
7.0 – 9.4	400 - 1000	7	

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**Table 2. Typical applications of small-scale wind units and generators
(Source: Karekezi and Ransja, 1997)**

Rotor diameter (m)	Typical rated power at 12 m/s wind speed	Typical applications and uses
1	50 W	Battery charging for lighting and communication in remote locations Multi-battery charging and communications; water pumping Heating and mufti-electrical uses, possibly with some battery storage Stand alone electricity generation for communities (small villages)
2	1 kW	
5	10 kW	
14	50 kW	

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Table 3. Small- scale wind power system (Source: Gipe, 2004)

Nominal Rotor Diameter(m)	Swept Area (m²)	Nominal Power(kW)
1.1	1	0.1
2.5	5	0.75
3.6	10	1
8	50	10-20
11	100	25-50

Table 4. Sample relative costs per kW for selected wind turbines

Rotor diameter m	Swept area m²	Estimated power (kW)	Cost estimate (US\$)	Specific cost (US\$ / m²)
.2	1	0.4	2,000	1,864
2.1	4	0.9	3,300	923
2.5	5	1	3,500	713
3.6	10	1.9	4,700	462
29	661	225	400,000	454

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- ***The Rationale for the Objective of the Proposed National Policy on Small-Scale Wind Power Development: The Case of Ethiopia:***
 - **The Introductory Background on Wind regimes and Wind Speed is provided as a review of what Wind Power is all about.**
 - **Why the energy conversions and applications of motive power of wind power were missed in Sub-Saharan African (SSA) countries including Ethiopia , also briefly outlined.**
 - **There has been substantial research work on the relative technological underdevelopment for a very long time (e.g. over 500 hundred years or so), and currently there are also still substantial needs for technology and management transfers.**
 - **So, next it will be worthwhile to state the Rationale and development themes for key Objective of the National Policies .**

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- ***The Rationale for/Objective of the National Policy Proposals could henceforth be stated and justified as follows:***
 - Essentially, there is one main objective of the contribution on the Proposed National Policies , which are to be followed by discussing and outlining ***the set of critical issues that could be recommended for rapid installations of small-scale wind plants,*** (in Section 3) and then these are followed by an outline of the ***Way Forward*** (Section 4).
 - Specifically though, it is important to note that, as in many other Sub-Saharan African (SSA) countries, and also in Ethiopia, there are:

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- **The Objective of the National Policy Proposals (continued):**

- **Very low disseminations of small-scale wind power systems and renewable energy technologies (RETs) in general throughout the country and most of SSA countries;**
- **Extremely few number of foreign/donor sponsored small-scale wind plants for water pumping installations, but not for electricity generation;**
and
- **Current attempts are being made to plan a national wind and solar energy strategies, but these are yet to be incorporated within the National Energy Policy of Ethiopia.**

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- The main objective will thus be tackled by formulating and outlining a number of *national policy issues* that have been applied in many other developing countries in using small-scale wind plants (possibly at different *modular scales*), but practically are unknown to, or non-existent currently in Ethiopia, in contrast with recent *appreciable wind power developments for grid integration*.
- Having introduced the setting on wind regimes as summarized above, the aim will henceforth be simply to contend that a given set of *interrelated national policy issues* will enhance opportunities for initiating small-scale wind plants in the country.
- Then, possibly the launching and initiating of installations of small-scale wind power systems could be regarded as part of the process of bringing the industrial revolution to *one relatively populous SSA country*.

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2 Draft National Policies for Small-Scale Wind Power Developments: The Case of Ethiopia: A Brief Outline of Relevant Terminologies: and Development Themes

- At the outset, it is very important to be clear about relevant terminologies that are to be used in outlining and formulating the draft national policy issues.
- To start with, by “policy” is meant either a “course of action” to be adopted, or a “prudent procedure” to be followed in aiming at implementing a set of plans or objectives.
- Then by a “national policy” is meant either a governmental or an academic course of action to be followed in pursuing the implementations of plans, as in in small-scale wind power developments in a less developed economy.
- While wind power generation for grid integration is being pursued extensively, Ethiopia is yet to be engaged in small-scale wind power developments.

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2. Draft National Policies for Small-Scale Wind Power Developments: The Case of Ethiopia: Terminologies (cont'd)

- Any governmental policy will of course be the result of a parliamentary act or set of decisions finally arrived at after extensive deliberations, preparations and debates.
- On the other hand, an academic or a theoretical policy proposal will be based on research activities and related investigatory works. In the present contribution, the drafted "national policy for small-scale wind power development" is a research output simply and directly based on an extended investigative study on lack of extents of renewable and energy technologies (RETs) for development in one less developed Sub-Saharan African (SSA) country, namely Ethiopia.

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2. Draft National Policies for Small-Scale Wind Power Developments: The Case of Ethiopia: Terminologies (cont'd)
- As shown below, the policy issues range from awareness creations, to training and capacity building, as well as to formations of income-generating activities, and ensuring or seeking supporting financial resources.
 - Based on applications of the proposed National Policies (NPs), it will be demonstrated that despite many constraints realized in the earlier energy programs, there are challenges and opportunities that could be made open to SSA countries like Ethiopia without the energy assistances being regarded as welfares projects. The draft policy formulations, being proposed are eight in all.
 - These will be appraised in Section 3 as Policy Recommendations, and the contribution will finally close with a statement on the "Way Forward", as presented in Section 4.

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2.1 First National Policy on Advancing an Awareness Creation and the Promotion of Community-Based Small-Scale Wind Power Developments in Ethiopia

- To base the First National Policy on installations of small-scale wind power developments in a country like Ethiopia, first and foremost a firm footing, an Awareness Creation of the promotion of Community-based Organizations (CBOs) for development will need to be the starting point.
- Needed initiatives will have to be taken by addressing and recognizing the root causes of energy underdevelopments in general and lack of rapid energy technology transfers, in particular, but without aiming at welfare projects. ss
- This approach is fundamentally missed in the ESAMP, Energy Sector Assistance and Management Programs (World Bank, 1996), or WSSD (World Summit on Sustainable Development) approaches and outlooks.

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2.1 First National Policy on Advancing an Awareness Creation and the Promotion of Energy Services and Technology Developments (continued)

- **Whatever forecasts are given in the forms of *de facto or exact rhetorical statements for general uses*, these will still need to be translated into more concrete local languages that can be appreciated by all rural communities with low incomes. Then, needed socio-economic transformations will need to be formulated in terms of, and related to *improved energy services and technologies*.**
- **Energy supply is a key factor in economic and social developments, but little attention is in general being given to the needs of rural communities in low economy countries.**
- **The First National Policy on Small-scale wind power developments, will henceforth need to be based on *an Awareness Creation on known energy technologies like Small-scale Wind Power* with existing and rapid recent innovations, that will need to be introduced to CBOs to concerned low income countries as early as possible.**

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2.2 Second National Policy on Launching of Training and Capacity Building in Small-Scale Wind Power Plants at Practical Levels for CBOs

- Irrespective whether wind power technology is a long-established technology with improved innovations, some kind of simplified training will be needed at its bases.
- Henceforth the Second National Policy will need to be aimed at launching of Training and Capacity Building Opportunities in Small-Scale Wind Power Plants for CBOs to be formed at the most Practical Levels
- There are gears, belts, pulleys and other metallic, wooden or plastic parts and components in assembling and mounting wind turbines with either horizontal (i.e. recommended turbines), or also for vertical-axis turbines.
- These will need to be introduced to qualified members (e.g. including graduates of academic institutions) of the rural communities that will be engaged in safely mounting the wind power systems, no matter how small, or complex.

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2.2 Second National Policy on Launching of Training and Capacity Building in Small-Scale Wind Power Plants at Practical Levels (continued)

- *The needed human resources and technical capability building or training could be offered by adapting existing programs in other advanced developing countries, and possibly also by taking lessons from other SSA countries that have succeeded in doing so.*
- *The only new or additional innovation needed is that the training programs be offered to representatives of community-based organizations, perhaps an experience that could be regarded to be new for an SSA country.*
- *Any training programs in the energy sector offered by the international financing organizations or private companies could be adopted as required.*

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2.3 Third National Policy on Supportive Financial Schemes of Small-Scale Wind Power Systems in Ethiopia:

- Other than awareness creation, the other key constraints are the initial high costs of small-scale wind systems and lack of financing with access to credit.
- Financing limitations have been making their developments unattractive or even unthinkable among all communities, especially rural CBOs, in Ethiopia.
- Any one of the renewable energy technologies (RETs) can not also be recommended for sustainable developments as welfare projects.
- The Third Issue in the National Policies for Small-Scale Wind Power Development in Ethiopia will henceforth be the need for recommending viable financing mechanisms for purchase of the needed equipment assembly and covering significant portions of costs of installation works.
- Other related constraints are shortage of hard currency, and lack of access to hard currency.

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2.3 ***Third*** National Policy on Supportive Financial Schemes of Small-Scale Wind Power Systems in Countries Like Ethiopia (continued)

- ***Lessons will also need to be learnt from successful experiences in introducing, promoting and installing wind plants of different classes and capacities.***
- **The financial requirements to be imposed by lenders and donors will likely include the following considerations:**
 - ***Pre-payment: conditions and capacities of the newly-to-be-formed rural CBOs for small-scale power developments will also need to be defined and formulated.***
 - ***Micro-finance opportunities could be made available to rural CBOs in line with local banking practices.***
 - ***Experiences could be learnt from similar agencies and donors in Europe and North America, and possibly also from Asia.***

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2.4 ***Fourth*** National Policy on Promotion Rural Income-Generating Activities in Association With Small-Scale Wind Developments in Ethiopia

- The ***Fourth*** National Policy for promoting small-scale wind small-scale wind power developments in Ethiopia is a proposal aimed at introducing Income generating Activities that will require new energy services and technologies.
- Utmost, the ***household energy requirements*** are restricted to cooking, lighting, water heating and space heating .
- However, the ***Fourth National Policy Issue*** proposes that renewable energy utilizations from Small-scale wind power developments be aimed at:
 - ***Income-Generating Activities***, like agricultural activities (e.g. water pumping for irrigation and livestock watering), and
 - ***Growing cottage industries*** (e.g. blacksmithing and pottery), weaving , grain milling and energy requirements for additional productive services.

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2.4 ***Fourth*** National Policy on Promotion Rural Income-Generating Activities in Association With Small-Scale Wind Plants in Ethiopia (continued)

- **Again, it will be important to learn from the experiences of other developing countries, so as to emphasize income-generating activities over domestic energy requirements in rural Ethiopia the uses of small-scale wind power.**
- **A wide range of small-scale manufacturing enterprises can also be promoted in rural areas such as small and medium-scale enterprises that could include small shops, rural guest houses, and battery recharging centers.**
- **By availing this group with modern energy services, a larger number of entrepreneurs can be built steadily, leading to a growing demand for modern energy services and home-based income-generating activities.**

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2.5 Fifth National Policy on Building Management Capabilities, Local Assembly and Manufacturing Capacities in the Country

- **The Fifth National Policy on Small-scale Wind Power Development in Ethiopia being proposed pertains to needs for building capabilities and growths in skills for local assembly and possibly also local manufacturing of wind components at local levels, and as rapidly as possible.**
- **The key issues involved are aimed at minimization of costs in installing, maintaining and operating small-scale plants successfully, again as apparently being done in other developing countries.**
- **Many small—to- medium-scale enterprises are commonly built by CBOs, initially with household members and limited initial skills.**

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2.5 *Fifth* National Policy on Building Management Capabilities, Local Assembly and Manufacturing Capacities in the Country (continued)

- **Most of the recommended enterprises are based on the informal sector which can be built into commercial/service enterprises and production enterprises.**
- **It is also clear that modern energy services will definitely open up certain opportunities for rural communities in Ethiopia that would not exist without them, even initially on a limited levels with small-scale wind power units.**
- **Besides, it can also be added that next to lack of awareness creation, as well as issues of financial constraints, adequate technical capacities are also needed for operating and maintenance activities.**

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2.6 ***Sixth*** Proposed National Policy on Appropriate Legal Frameworks for Small-Scale Wind Plant Developments

- The proposed National Policy on Small-scale Wind power development in Ethiopia ***will also need to consider general and specific legal frameworks and issues*** that pertain to utilization of wind power in unaccustomed rural areas.
- Above all, ***there are safety issues*** to be considered in the mounting of wind turbines, since no matter how small, wind turbines are mounted on towers that in fact continually face wind forces (Gipe, 2004).
- Besides, there could also be needs for ***“harmonizing existing legislation in order to ensure rural communities about the safeties of wind systems”***. This has to be done in collaborations between regional energy bureaus and the CBOs to be established.

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2.6 ***Sixth*** National Policy on Legal Frameworks for Small-Scale Wind Plant Developments in Ethiopia (cont'd)

- **Any legal problems in promoting Small-scale wind plants will need to be recognized** so as to revise or update existing legislations. Again, useful experiences will need to be learnt from the advanced developing countries that have succeeded in building wind power both for grid integrations and for off-grid initiatives and systems.
- **A suitable legal framework** will thus be necessary to allow the creation of an autonomous body to allow the promotions of small-scale plants to be owned by rural cooperatives of CBOs in the country.
- **Such a body will need to have regulatory and enactment powers**. The actual administration of wind energy supply and distribution and revenue collection could be left in the hands of the CBOs. Possibly, there could also be challenging legal hurdles hindering smooth power distributions among CBOs in similar rural areas in general in the developing countries.

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2.7 Seventh Proposed National Policy on Guaranteeing Compliances with National Energy Policy and International Standards on Small-Scale Wind Plants in Ethiopia

- **Aside from the legal framework needed to promote and advance small-scale wind power developments in Ethiopia, it will also be necessary to comply with the National Energy Policy of Ethiopia.**
- **The Seventh National Policy on Small-Scale Wind Power Development in Ethiopia henceforth will need to comply the National Energy Policy of Ethiopia, and other related international Standards and requirements for certification.**
- **As indicated earlier, the National Energy Policy of Ethiopia, first formulated and enacted in 1994, is currently being updated and expanded.**

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2.7 Seventh proposed National Policy on Guaranteeing Compliances with National Energy Policy and International Standards on small-Scale Wind Plants (continued)

- **If found feasible, a suitable legal framework might also be necessary to allow the creation of an autonomous body to allow the creation of small-scale plants to be safely operated by rural cooperatives in the rural areas of Ethiopia. Such a body will also need to have regulatory and enactment powers, as proposed in the Fifth National Policy on Small-Scale Wind Power Development.**
- **The actual administration of wind energy supply and distribution among the community members, and possible revenue collection could be left in the hands of the CBOs.**

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2.8 *Eighth* National Policy on Launching and Undertaking Relevant Research and Development Activities on Small-Scale Wind Plants in Ethiopia

- **It is seen necessary to undertake basic research on small-scale wind power developments and hybrids of renewable energy technologies (RETs).**
- **The *Eighth* National Policy thus proposes that it will henceforth be beneficial to evaluate new technology and product developments by following standard R&D activities at any level.**
- **Additionally, small-scale wind plants are basically to be developed and configured around isolated or distributed generations, they are going to be likely costlier than the grid connected wind power systems. Will there be also needs for energy storage facilities?**

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2.8 ***Eighth*** National Policy on Launching and Undertaking R & D Activities on Small-Scale Wind Plants in Ethiopia (cont'd)

- **The R&D activities could be made as relevant as possible, and in the process, even if done at preliminary levels, the results obtained could be useful in many respects.**
- **Taking the available wind resources in Ethiopia, it could further be ascertained whether many of the wind machines designed for European or Asian wind regimes could be usefully installed, or adapted with possible innovations in Ethiopia also.**
- **Henceforth, with a minimum R&D activities, while as envisaged, its actual wind energy resources could be assessed reliably for expanded applications. In initiating the R&D processes, additional supports will of course need to be sought from the appropriate sources.**

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3. Policy Recommendations and Justifications of Small-Scale Wind Power Developments in Ethiopia for Community-Based Organizations

- Whatever rural energy initiatives are to be launched in Ethiopia within the foreseeable future, it is strongly being recommended that renewables be given the highest priorities. These will include the promotions of wind power and solar energy, as well as hydropower units of different capacities ranging from watts to kilowatts and, megawatts. Above, it is contended that community-based organizations would have the best opportunities for adapting needed innovations and productive activities. Any suitable and economically viable hybrids of RETs could be seriously considered. The conventional energy sources (egg those based on diesel generation) will still be urgently needed, but at higher operational costs.
- The needed renewable energy technologies (RETs), notably small-scale wind power systems for both water pumping and electricity generation), could be either totally or partially imported. The non-renewable ones (additionally including gas generators and kerosene stoves, or lamps) could also be installed easily at convenient locations for immediate uses, but only on the bases of individual household energy requirements. Henceforth, it is obvious that small-scale wind power developments are seen to be more viable for community-centered energy development especially for the benefits of farming communities, pastoralists and rural commercial enterprises. In principle, modern energy services and options in rural areas. It is being contended that a hybrid of RETs could be promoted through a combination of financial incentive and managerial skills.
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3. Policy Recommendations and Justifications of Small-Scale Wind Power Developments in Ethiopia for Community-Based Organizations (cont'd)

- Wind energy potentials have been found to be viable for both electricity generation in many parts of the country (Wolde-Ghiorgis, 1988). Henceforth, the country is benefitting from wind power generation in wind farms for grid integration.
- There are also wind energy resources that are definitely adequate for water pumping applications in wider areas of the country (CESEN, 1986b). **Besides, it has been shown that there are windy sites more suitable for small-scale wind power generation more economical than uses of diesel generation** (Sharew et al., 2001).
- The Policy Recommendations to be selected are to be based on their direct impacts on advancing energy initiatives for needed technology transfers with managerial skills (Kennedy, 2005).
- The starting point will be by taking seriously the technology transfer issue (i.e. for wind power capacities of 0.1 kW to 50 kW) of complete of small-scale wind systems that could also be replicated at suitable sites for legally – organized rural communities.
- Preliminary research on economic factors and technology options have also provided the following options (Wolde-Ghiorgis, 2004).

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3. Policy Recommendations and Justifications of Small-Scale Wind Power in Ethiopia for CBOs (cont'd)

- **Whatever rural energy initiatives are to be launched in Ethiopia within the foreseeable future, it is strongly being recommended that small-scale wind be given the highest priority. There could also be the promotions of hybrids of wind power and solar energy, as well as hydropower units of different capacities ranging from watts to kilowatts and, megawatts.**
- **It can further be contended that CBOs would have the best opportunities for learning from, and adapting needed innovations and productive activities.**
- **Small-scale Wind Power systems could be developed for water pumping and electricity generation, and the technologies could be partially manufactured locally.**

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3. Policy Recommendations and Justifications of Small-Scale Wind Power Developments in Ethiopia for Community-Based Organizations (cont'd)

- **It is further seen to be more viable for CBOs that can benefit farming communities, pastoralists and growing rural commercial enterprises by promoting small-scale wind power systems.**
- **As indicated earlier, some components could also be locally manufactured to reduce taxation and importation costs.**
- **Importations of wind generators and more complex control units could also be made exempt from taxes.**
- **Coordinating the CBOs for the implementation of rural electrification around sites could be established.**
- **Job opportunities could also be created for people in rural communities after basic training and capacity building.**

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3. Policy Recommendations and Justifications of Small-Scale Wind Power Developments in Ethiopia for Community-Based Organizations (cont'd)

- **Loans with minimum interest rates and longer pay-back periods could possibly be provided and extended to legally organized communities, subject of course to the highly restricted rules and regulations of the major international financing organizations (i.e. both within and outside Africa).**
- **Both pilot and ongoing Small-scale wind plant systems could be designed and built to familiarize rural communities (i.e. settled farmers, pastoralists and small-scale enterprises) with the benefits of wind energy.**
- **Interests and supports from non-profit organizations (or non-governmental organizations could be solicited for rural electrification programs in SSA countries, as being done for health programs and environmental impact and assessment programs.**

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4. The Way Forward: Challenges, Prospects and Priorities

- The way forward for Small-scale Wind Power Development in an SSA country like Ethiopia is full of many and innumerable challenges that are to be addressed, recognized and faced.
- There are still definite prospects and opportunities for launching viably and initiating small-scale wind power developments that necessarily arise advancing the overall energy sector in the country.
- In addition to grid interconnections of wind farms, what are needed are off-grid power generations from available wind resources for the direct benefits of settled farmers and pastoralists.
- Then, there are opportunities to be exploited within the shortest possible times, with pressing needs to set priorities in line with the national energy policy of the country, despite missed opportunities in the past (Wolde-Ghiorgis, 2002a, 2002b).

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4. The Way Forward: Challenges, Prospects and Priorities (cont'd)

Priorities to be set for Small-Scale Wind Power Developments in Ethiopia:

- **Within and along the EMASP approaches, much has not been really achieved in introducing and initiating RETs and new energy services for countries like Ethiopia.**
- **Economically, technically and managerially, it will be totally impossible to supply needed energy services to all rural consumers and semi-urbanized community centers in Ethiopia from the national grid.**
- **Also, if poverty is to be eradicated, and sustainable socio-economic transformations are to be achieved, it will then be necessary to bring about significant changes in promoting newer energy services and technologies (Wolde-Ghiorgis 2004).**
- **So, Ethiopia will need to exert serious efforts to mobilize its national capacity to achieve the desired objective in line within the proposed National Policies for Small-scale Wind Power Developments.**

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4. The Way Forward: Challenges, Prospects and Priorities

Closing Remarks:

- In closing the draft proposals on National Policies (NPs) on Small-Scale Winds Plants in Ethiopia (*eight in all*), it could be stressed that these RETs definitely appear to have promising futures if rural community-based-organizations (CBOs) are carefully and genuinely promoted as soon as possible as already done extensively in many Asian and Latin American countries.
- The standard concepts and methods employed for assisting privately-owned investments could still be considered seriously by interested international financing organizations with appropriate requirements.
- Within the proposed NPs, there could also at least be initiatives to be included in a national Energy Development that must include small-scale wind power and other hybrids (notably photovoltaics). as key components of hybrids of RETs.

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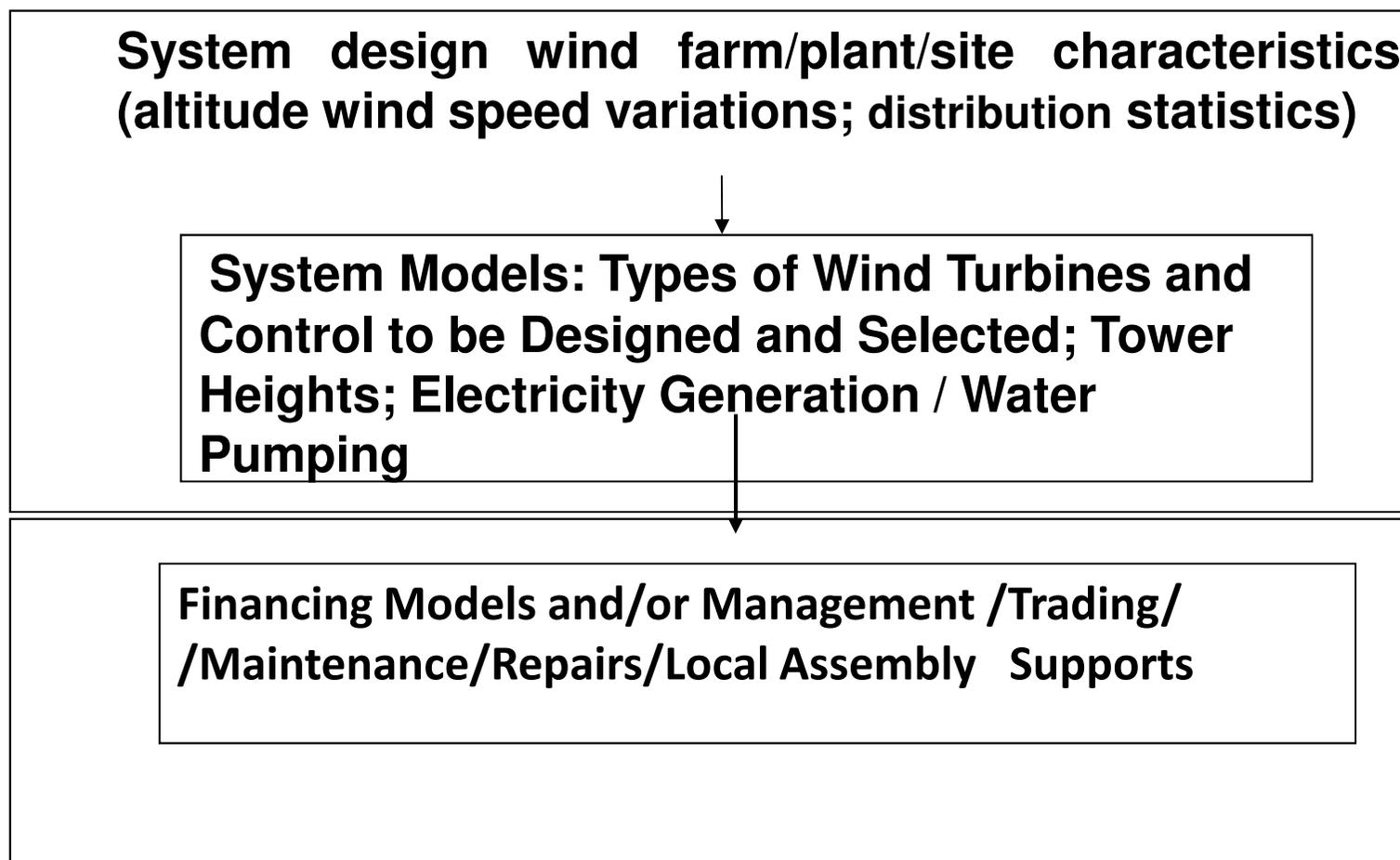
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6. Annexes: Annex 1: Map of Ethiopia with sample windy sites shown shaded around four regions with substantial wind energy distributions (wind speed > 5 m/s), and with potential areas for wind power generation for grid integration, and possibly also for rural community-based or organized developments (Source: Ethiopian Electric Power Corporation, Ministry of Water and Energy, Addis Ababa, Ethiopia)



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Annex 2: System planning and management for launching wind power generation initiatives in wind plants/farms for off-grid and grid integration (after Kennedy, 2005)



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Thank You