Energy Policy for Landlocked Countries

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1. Landlocked Countries - Background

World markets are especially difficult to reach for landlocked countries, not only because of the limited possibilities to access them but also for the several structural difficulties that arise from being landlocked.

There are 48 countries in the world that are currently landlocked where 4 of them are disputed regions with limited international recognition, i.e., not widely recognized as countries. The fact that 33 of the 44 landlocked countries are developing nations seems to indicate that landlockedness affects the overall development of a nation. The inability to trade in fair conditions is one of the main reasons for the lagging of sustainable development some landlocked countries. As indicated in [1] trade routes through neighbor countries can be affected by several factors such as

- peace and stability of transit countries,
- administrative burdens associated with border crossing which will increase transportation costs and cause long delays on transit traffic,
- political relation with transit countries.

The global community has acknowledged the extreme vulnerability of landlocked countries by means of the Article 125 (1) of the United Nation Convention on the Law of the Sea (UNCLOS),[2], which states that

> *"Land-locked States shall have the right of access to and from the sea for the purpose of exercising the rights provided for in this Convention including those relating to the freedom of the high seas and the common heritage*

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of mankind. To this end, land-locked States shall enjoy freedom of transit through the territory of transit States by all means of transport." (Article 125 (1), of the United Nation Convention on the Law of the Sea).

Article 125 (2-3) of the mentioned UN convention clarifies that the right of access must be agreed with the transit neighbor, which in theory allows transit nations to delay the right of access almost indefinitely. In this regard, it is interesting to note that 13 of the 33 landlocked developing countries have not currently signed the aforementioned agreement; this is the case of the landlocked countries of Central Asia where none of them have ratified the UNCLOS.

The energy aspects in landlocked countries need to be addressed. The Workshop on "Innovative Energy Policies for Sustainable Development" in Trieste, Italy from 8-13 December 2013 was held as part of TWAS – AAAS International Science & Diplomacy Programme of the world academy of sciences. In the Breakout Session three groups were formed to develop policy of a Petro State, a Least Development Country and a Land-locked country. The following are the members of the Landlocked Country Group,

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2. Energy in landlocked countries

2.1. Hypothetical Case Study

Energy plays an important role for the development of a society, not only as a trade goods, but also as a sine qua non element for manufacturing high-value goods. The hypothetical country in question has vast fossil fuel reserves. Energy systems in landlocked countries may suffer from the inability to export or import energy in fair conditions, which can result in a lack of enough energy for local use and/or in the inability to sell the surplus energy. The aforementioned "special" situation of landlocked countries makes energy policy a powerful tool to achieve social and economical development.

The hypothetical landlocked country has large markets to the east and west, but in order to derive revenue from its resources, it must "pay" to have oil and/or gas piped through neighboring countries to the closest sea ports. However, relations with neighbors have been strained for the past 10 to 20 years and any pipeline following the shortest

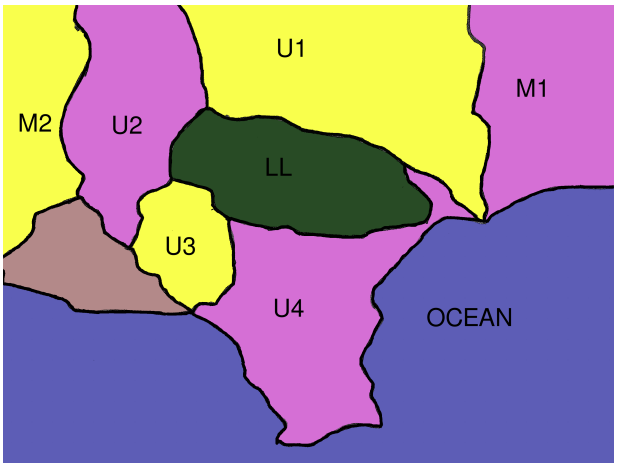

Figure 1: Political map of the hypothetical region of study. LL is the landlocked country under study, U1, U2, U3 and U4 are "unfriendly" neighbor countries with U4 being politically unstable, M1 and M2 are potential markets for the energy resources of LL.

Table 1: Current situation of the hypothetical country under study

Access to electricity (% of the total population)	60
Energy imports (% of total energy use)	30
Energy exports (% of total energy generated)	7
Pollution (CO_2 emissions, SO_x emissions, etc)	High
Research and Development in the Energy Sector (% of the total Budget for energy)	2.5

distance to the sea (to the south) would have to traverse a region that has been politically unstable for a long time. Figure 1 depicts the hypothetical region near the landlocked country under study (LL). Table 1 summarizes assumptions made about the current situation of developing LL country.

2.2. Goals Setting for 2050

The first step towards defining the energy policy was to set clear and measurable goals for a specific time frame, in this case until 2050. The proposed 2050 roadmap comprises the definition of goals for three periods, namely, from the present time to 2020, from 2020 to 2030 and from 2030 to 2050. We expect that the advancement towards the goals will be nonlinear due to the necessity to prioritize access to electricity and reduction of energy imports. Goals of energy policy towards sustainable development are one hundred percent access and availability, affordability, sustainable investment, pollution reduction and R & D. Table 2 lists the goals and respective indicators we are proposing for the aforementioned periods.

Table 2: Setting Goals in the energy sector for different periods until 2050

Goals	Today	2020	2030	2050
Access to electricity (% of the total population)	60	80	100	100
Imports (% of total energy use)	30	25	15	5
Exports (% of total energy generated)	7	10	12	17
Pollution (CO_2 emissions, SO_x emissions, etc)	High	Med.	Low	V. Low
Research and Development in the Energy Sector (% of the total budget for energy)	2.5	5	10	15

2.3. Strategy and recommended policies

Given the geographical situation of the country under study, diplomacy should be considered when making the energy policy. Diplomacy should be oriented towards building good relationship with neighboring countries, making them understand that establishing good relations in the region can be beneficial for all. As described later, we propose to use science for diplomacy programs, more specifically; we would like to establish regional energy-related joint research programs and a regional scientist mobility program.

A special emphasis has to be given to make energy affordable by lowering local energy transportation costs. Such cost reduction will have two positive effects, namely

- it will eventually lower the local energy costs, which can make it possible to manufacture high-value goods that are not so vulnerable to the landlockedness,
- it will make more profitable the export of energy (fuel or electricity) to other countries specially when the relation with the neighbors gets better.

Finally, local fossil fuel resources should be exploited in a sustainable and clean way. In this regard, research and development should be oriented towards the aforementioned goal, for instance, developing novel CO2 capture sequestration and storage techniques, renewable energy technologies and technology transfer.

2.4. Budget Categories and Distribution

We have identifies the budget categories listed in Table 3.

The distribution of the budget during the defined periods until 2050 is shown in Table 4. Notice that diplomacy is a small component to begin with and grows with time. While as diplomacy grows countries come together, security and maintenance, which is high at present reduces. Our budget distribution favors local energy infrastructure and systems, investment in foreign technology (technology transfer) and local research and development. Energy imports needs to be kept initially high to ensure energy for local needs.

Table 3: Budget Categories

Category	Description and notes
Research and development	Activities performed by universities, research centers, public or private companies oriented to developed applied or theoretical research in the energy sector. Resources can be allocated directly to research centers of excellence or by open calls to specific topics such as renewable energies, energy efficiency, CO2 capture, storage and re-use, hydrogen, transport and processing of energy.
Import of energy	We are assuming a lack of local fuel processing facilities, thus the majority of the import energy is currently fossil fuel derivatives such as gasoline or diesel.
Investment in technology transfer	Includes energy transfer to or from foreign countries. We will focus on acquiring efficient clean fossil fuel related technologies.
Diplomacy	Science diplomacy programs with the objective of improving the energy relationship with neighboring countries. Such programs will be regional. For instance, campaigns for the rational and clean use of energy and clean energy generation can be promoted at a regional level. With the resources allocated to this category exchange of scientists, joint research projects.
Local energy systems	Includes the investment in new infrastructure in energy generation, fuel processing, energy transmission and distribution as well as fuel transportation.
Security and maintenance	Local energy infrastructure requires maintenance and potential energy infrastructure located or connected with neighboring countries requires surveillance.

Table 4: Percentage of budget allocation

Category	Now - 2020	2020 - 2030	2030 - 2050
Research and development (incld. education)	5	10	15
Import of energy	25	20	15
Investment in technology transfer	25	20	15
Diplomacy	5	10	10
Local energy infrastructure and systems	30	35	40
Security and maintenance	10	5	5

References

[1] M. Faye, J. Mcarthur, J. Sachs, T. Snow, The challenges facing landlocked developing countries, Journal of Human Development 5 (2004) 31–68.

[2] U. Nations, United nations convention on the law of the sea (unclos), Tech. rep., United Nations (December 1982).