

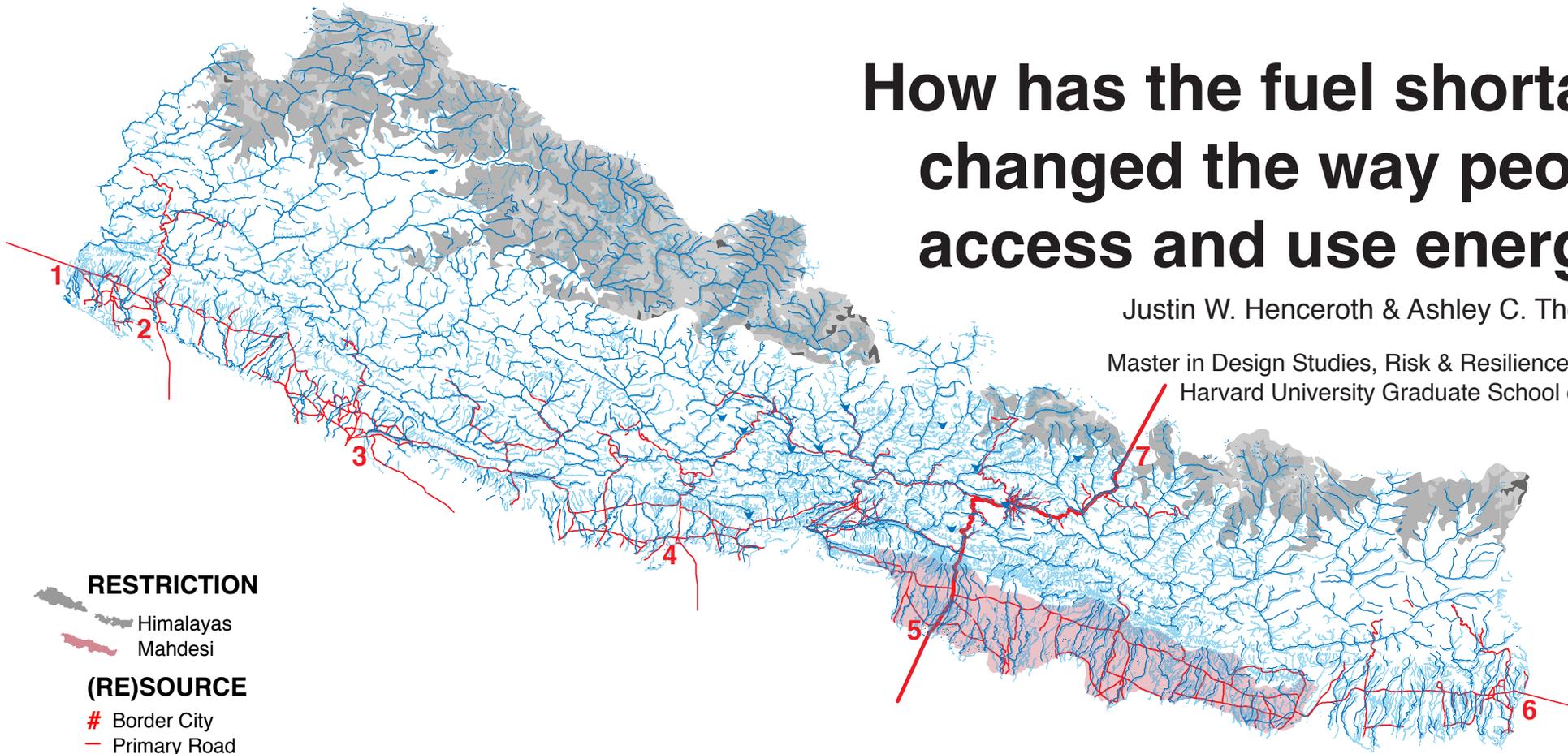
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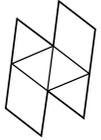
ENERGY

How has the fuel shortage changed the way people access and use energy?

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ENERGY OVERVIEW

Nepal is struggling to procure and maintain a steady and sufficient supply of energy.

In response to the new constitution signed on 20 September 2015, an undeclared border blockade has created an energy shortage throughout the country. Activities reliant on fuels such as cooking, heating, and transportation have been severely curtailed, forcing people to shift fundamental energy needs, both personal and professional, to rely on secondary energy sources such as the national power grid. Since onset of the unofficial blockade, demand on the national grid has doubled, severely straining the existing system and its limited capacity. Dominated by run-of-river hydropower, Nepal's electricity production is affected by seasonal flows. Load shedding is typical in the winter; however, the overwhelming increase in demand has extended blackouts up to 18 hours a day. The fuel shortage is highlighting the fragility of Nepal's energy sector.

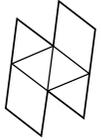
With response and recovery from the Spring 2015 earthquakes ongoing, the blockade and collateral energy shortage comes at a crucial time. Many people throughout the country remain in temporary shelters and are at particular risk in the cold winter season. The energy shortage additionally threatens reconstruction efforts, for example by inhibiting transportation of materials and staff, and further impacts the health and safety of people throughout Nepal.

As a sector that has been predominantly dependent on imports from India, the overall energy situation is also highly politically sensitive. Fuels that can only be procured internationally supply much of the country's energy, and domestic sources of energy have not been sufficiently developed to meet demand when those are not available. Even after the border blockade is resolved, the energy sector in Nepal will remain fragile, threatening recovery and development.

Alternatively, these challenges have highlighted a number of opportunities where Nepal might shift towards more sustainable and comprehensive development of the national energy sector. According to one government official, the fuel shortage has reprioritized resident's estimation of self-sufficiency regarding access to energy. Urban residents now consider alternative sources of energy, such as solar systems, a "basic necessity" to ensure energy security. This powerful new perspective is creating opportunities for innovation in energy. Initiatives that integrate more sustainable forms of energy into earthquake recovery and long-term development will contribute to long-term resilience for individuals and the nation.

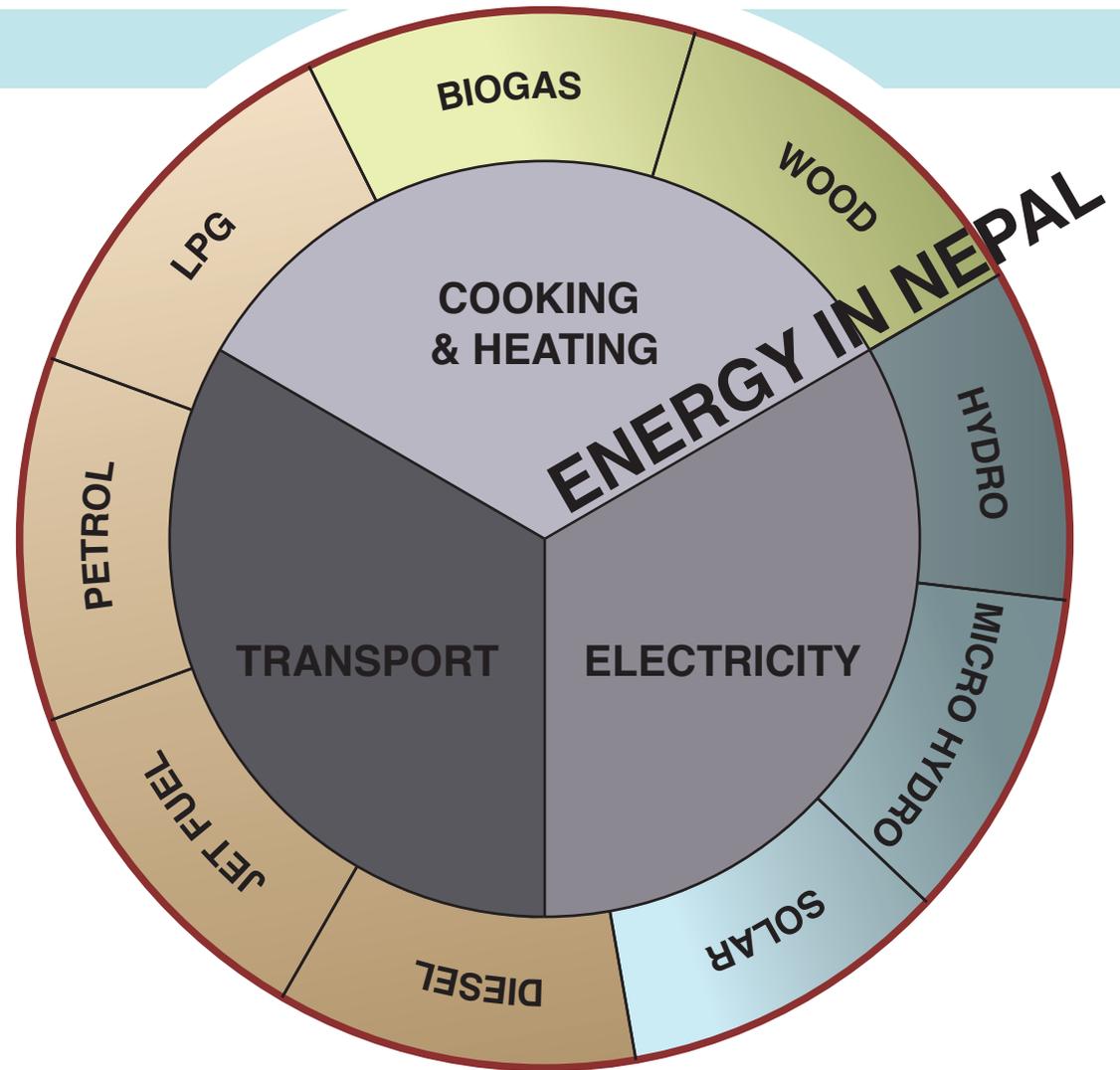


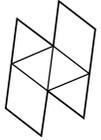
Produced by MDes Risk & Resilience Candidates Justin Henceroth and Ashley Thompson
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ENERGY IN NEPAL

Energy in Nepal has three primary uses: cooking and heating, transportation, and electricity. The needs for these uses are supplied through a number of different sources. These sources include traditional fossil-fuels, renewable sources, biomass, and hydropower. Throughout the country, people opt for these different sources based on their unique situation and needs. The border blockade has shifted how people relate to and utilize each source of energy. These changes provide insight into how energy has been used in Nepal and how that is changing.





FOSSIL FUELS

Diesel, Jet Fuel, Petrol & LPG

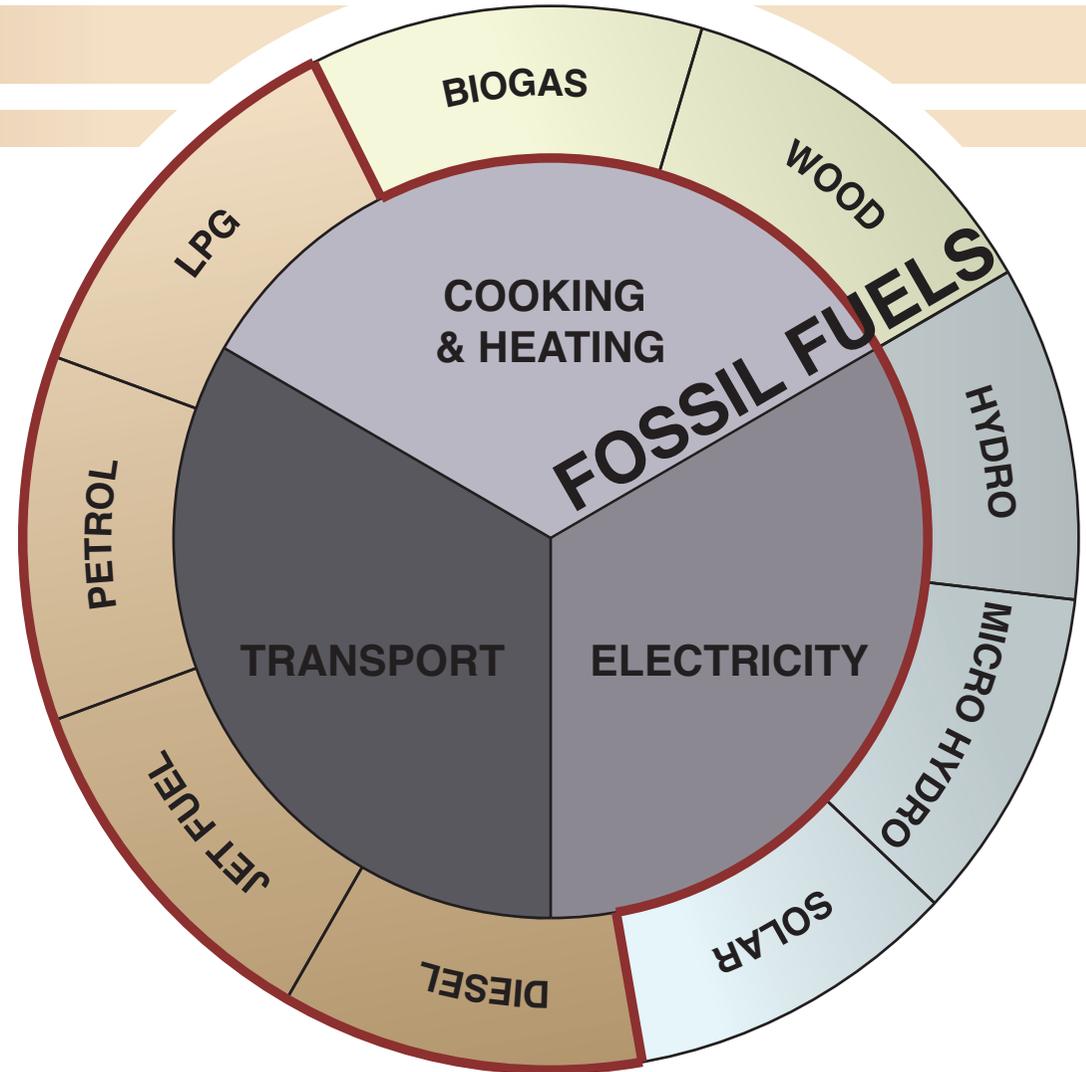
Diesel and petrol are primarily used for transportation, although vehicles may be converted to operate on alternative carbon fuels including petroleum gas (LPG), natural gas (LNG and CNG), or kerosene (SKO). Diesel is also commonly procured to operate generators. As Nepal does not produce any oil and does not have its own oil refinery, the landlocked country depends on imports of refined fuel. The Nepal Oil Corporation is solely responsible for the import, transportation, storage, and distribution of petroleum products.

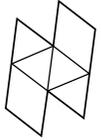
Pre-Blockade:

All petroleum and fuel products were sourced exclusively from India and transported by tank truck in accordance with an agreement between the national oil companies as last ratified in April of 2012. To meet increasing demand, particularly of LPG, an agreement for the construction of a cross-border pipeline from India to Nepal was negotiated in August of 2015.

Post-Blockade:

An undeclared border blockade has severely limited the import of all fuel products (and other critical goods) from India since Nepal's new Constitution was adopted on 20 September 2015, resulting in collateral supply-chain impacts across sectors. Official distribution has been periodically available; distribution points and times are made available on government websites, but acquiring official distribution requires waiting in long lines. Further, rations provided through official channels are small: LPG cylinders are only filled halfway and cars and vehicles are limited to a few liters of petrol or diesel (5 liters for 2-wheel vehicles and 10 liters for 4-wheel vehicles). Outside of official channels, a thriving black market has emerged. Costs of all fuel are dramatically higher in the black market. Diesel and petrol cost about double the official rate, while LPG has remained scarce and costs 6 to 7 times the official rate. Because of a shortage of aviation fuel, Long-haul commercial airliners are flying into the country with double the needed supply or are diverting for refueling upon departure from Kathmandu. On the 28th of October, Nepal signed its first ever fuel agreement with China and has remained in talks since; however, beyond two initial emergency fuel provisions, the talks have not resulted in a new trade agreement or commercial mechanism for importing fuel from China. Most local residents anticipate the fuel shortage will endure for many months.





RENEWABLES

Solar

Solar systems are common and are primarily used for lighting, communications, and household appliances. Larger systems may be used to power large equipment for heating, cooking, and transport. Systems are generally available to and affordable for many Nepalese people; however, after-sale operation and maintenance as well as power storage remain challenging.

Pre-Blockade:

Domestic solar power arrays were primarily targeted for installation in rural areas, where the national grid is unavailable, as the core mission of the Alternative Energy Promotion Center.

Post-Blockade:

With the national grid increasingly unable to meet daily power requirements, demand for both domestic and commercial solar systems has sky-rocketed. Increasingly, solar systems are viewed as a necessity to ensure independent energy security for both personal and commercial purposes. New government initiatives are rolling out to both incentivize alternative energy sources, solar and others, as well as mandate inclusion in development and construction.

Microhydro

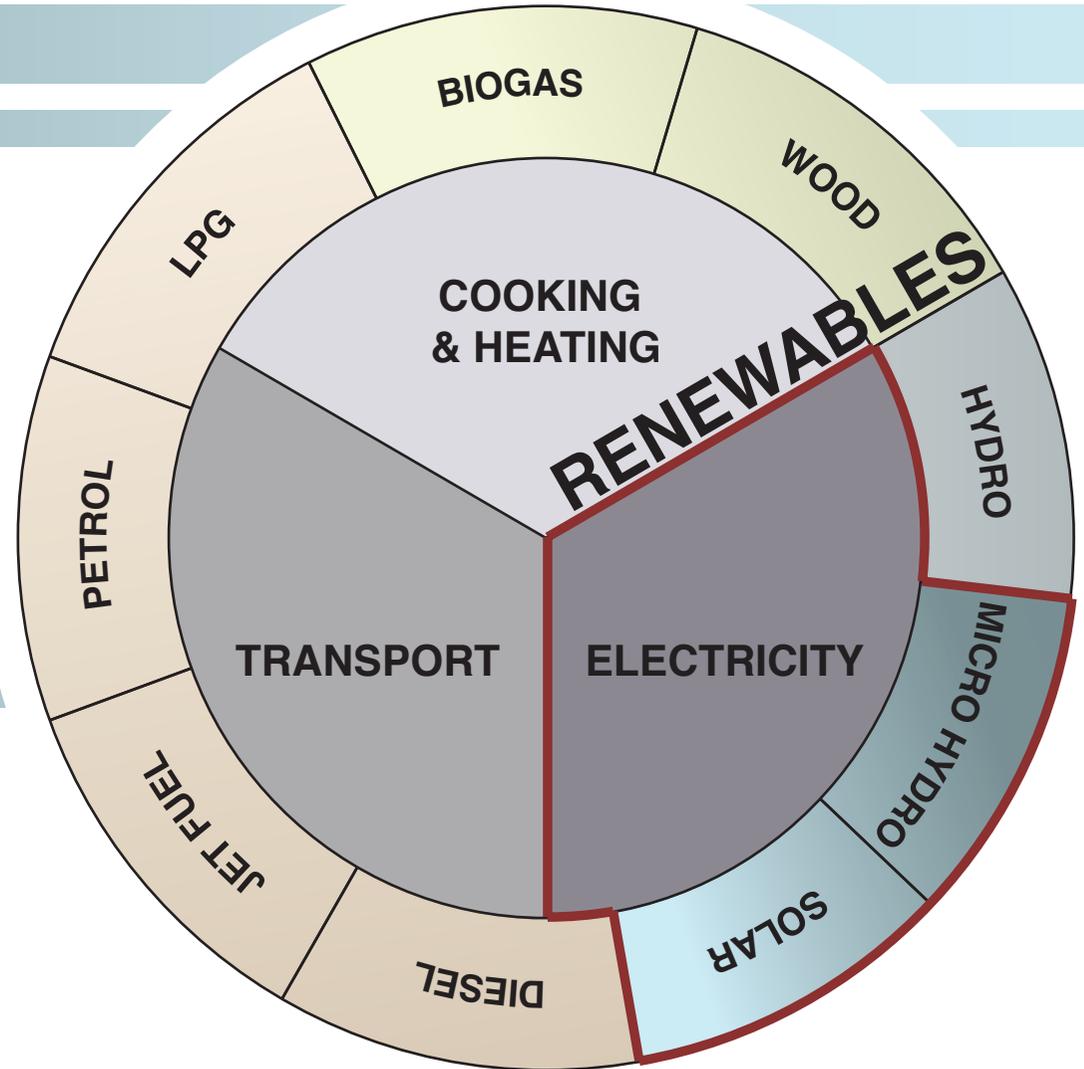
Micro-hydro systems, and even smaller pico-hydro systems, can provide electricity in rural areas by generating power from small streams and rivers. The design and scale of the systems has minimal impact on the ecosystems and flows of rivers, and electricity generated can be used for lighting, communications and powering small appliances in a household. The electricity generated can also be used for agricultural processes such as grinding, hulling, and milling.

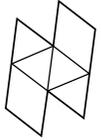
Pre-Blockade:

Micro-hydro systems have been installed throughout the country in rural and remote villages. They have proven particularly effective in the hilly and mountainous parts of the country. As of July 2012, over 2900 micro-hydro plants were functional in Nepal generating over 28 mega watts of electricity.

Post-Blockade:

Since the blockade, micro-hydro systems have been highlighted as a source of electricity that reduces reliance on the national grid. In addition, the National Reconstruction Authority included guidance for installing micro-hydro within its guidelines for earthquake reconstruction. However, because of limited supply of construction materials and fuel for transport as a result of the blockade, there has been limited construction of new facilities.





BIOMASS

Wood

Wood is predominantly used for domestic cooking and heating, particularly in rural areas where it may be sourced from the surrounding forests easily and affordably. Consumption of wood fuel is steadily increasing and deforestation is a concern.

Pre-Blockade:

Rural and semi-rural areas relied predominantly on wood for cooking and heating whereas urban areas were supported by gas for the majority of cooking and heating needs.

Post-Blockade:

Where cylinders of gas are extremely scarce, nearly all domestic and commercial cooking and heating requirements in urban areas have shifted to wood fuel. Sourced from the surrounding hills, two distribution sites have been established at the north and south of the Kathmandu Valley. Wood is distributed by the Nepal Timber Corporation; however, the growing demand has resulted in periodic shortages. A small black market in wood has also developed, with costs at peak times reaching as much as 6 times the official rate. Exacerbated by the winter, Nepali people have significantly adapted their lifestyles to manage the gas shortage and the subsequent impacts of burning wood for fuel.

Biogas

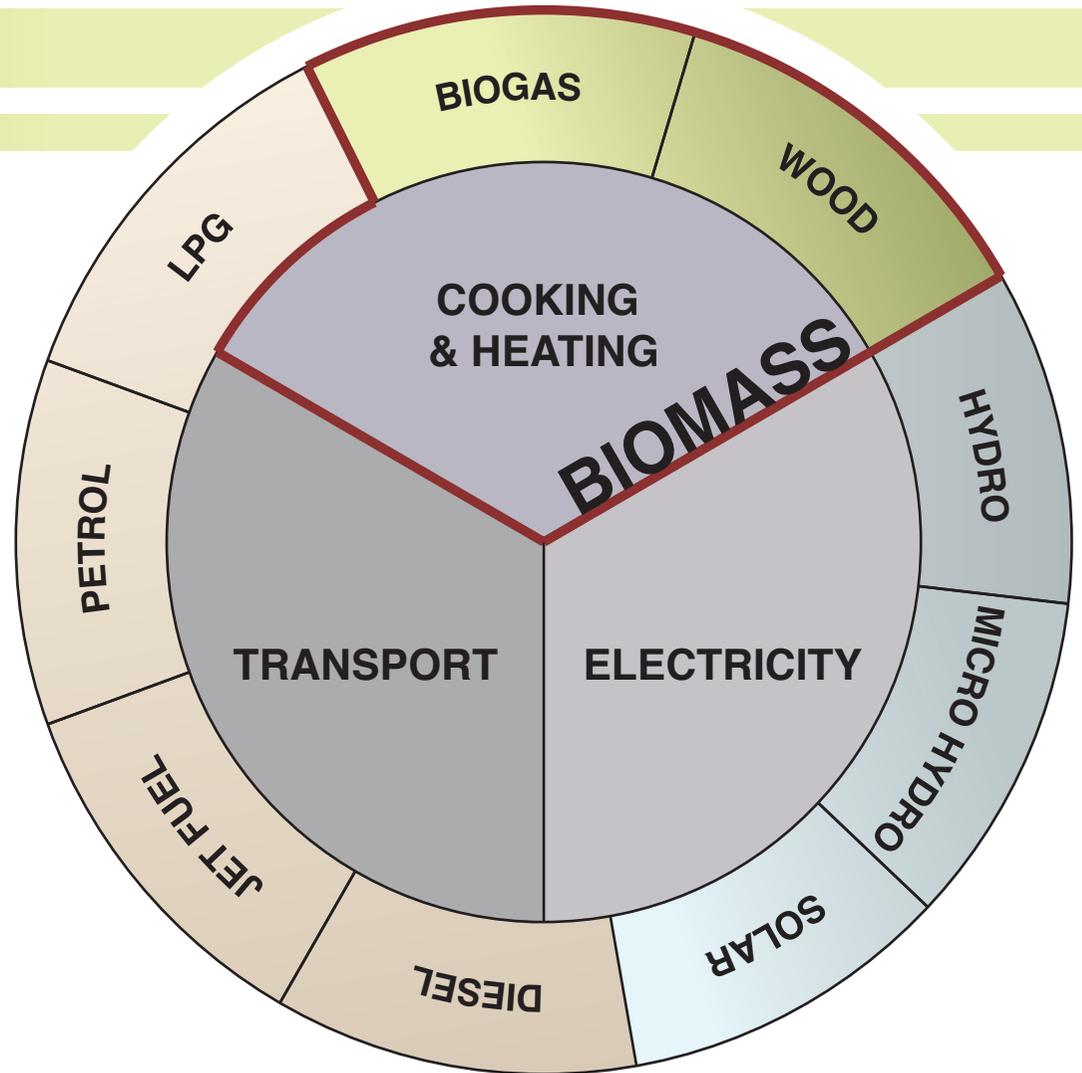
Biogas facilities convert agricultural waste and animal dung into gas that can be used for cooking and heating. In rural and peri-urban parts of Nepal, there is sufficient agricultural waste to provide large amounts of gas. The facilities range in size from those that service a single household to the village or industrial scale. Biogas produces fewer carbon emissions than conventional gas. Other biofuel products, such as compacted briquets, are also produced, particularly as fuel for improved cookstoves. The government has prioritized installation of improved cookstoves throughout rural Nepal.

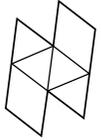
Pre-Blockade:

Nearly 300,000 biogas plants have been installed throughout Nepal. Most of these are small (4 kW to 6 kW); however some industrial plants exist near Kathmandu. Of these plants, nearly 200,000 have been registered with UNFCCC so that reductions in emissions can contribute to Nepal's goals under the Paris Agreement and other accords.

Post-Blockade:

Biogas plants are seen by many as an important piece within a suite of sustainable energy technologies that will help households be self-reliant. Biogas plants are not included in the National Reconstruction Authority guidelines for post-earthquake reconstruction, but many NGOs and organizations have included biogas plants in reconstruction activities.





HYDROPOWER

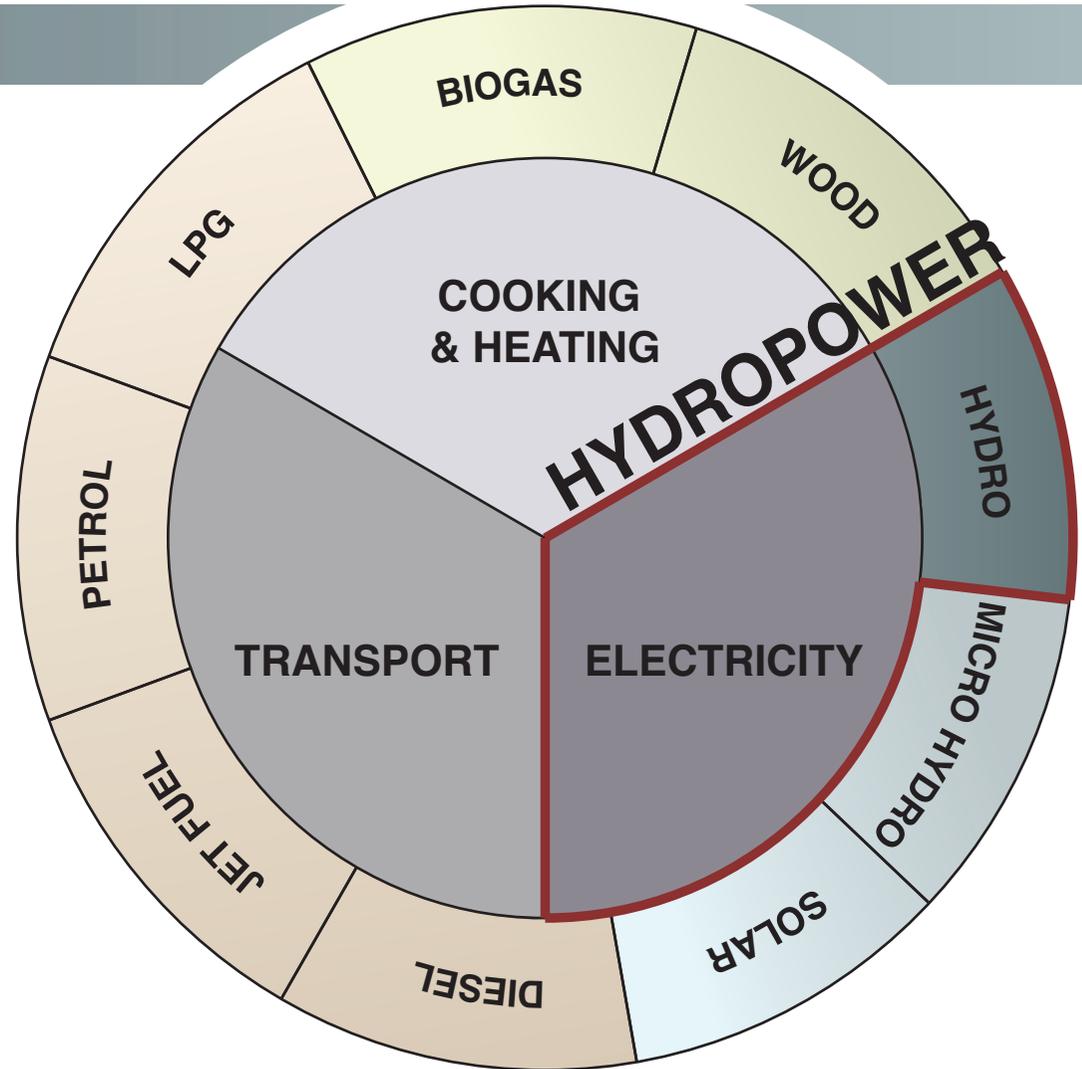
Hydropower is Nepal's primary source of electricity for the national electric grid. Hydropower is produced through flow-of-river hydropower facilities which maintain the natural flow of the river or stream. This ensures that enough water flows through rivers and streams to support agriculture downstream. Flow-of-river hydropower is also less disruptive to the environment. However, because the rivers flow naturally, when flows are reduced during the winter season less electricity is produced.

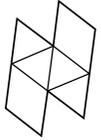
Pre-Blockade:

Nearly 90% of the electricity produced in the country comes from hydro-power (with the remaining portion coming from fuel plants). During past winter seasons, low energy production had resulted in load-shedding of up to 10 hours per day. In order to increase the reliability and performance of the national electric grid, the Government of Nepal developed plans to invest in new hydropower systems that would meet the country's growing energy demands. China and India have both invested heavily in hydropower projects in the country and are interested in opportunities to export energy.

Post-Blockade:

As a result of the energy blockade, people are shifting many key domestic and professional activities to utilize electricity from the national grid. For example, instead of cooking with gas, people are cooking with induction heaters and rice cookers. This has nearly doubled electricity demand on the grid, all at a time when hydropower production is smallest due to seasonally low river flows. As a result, Nepal is experiencing load-shedding of up to 18 hours per day. The energy shortage has renewed interest in hydropower investments, with the government of Nepal reaffirming its commitment to finishing planned hydropower projects on schedule. Government projections show that when completed, planned hydropower projects will meet the growing energy demands in Nepal and will reduce the blackouts the country currently experiences. However, these projections do not account for shifts in energy usage as experienced in the current situation, which, if some shifts remain permanent, will result in increased future demand.





ACTORS

Energy Users: Individuals, Households, and Businesses

Energy is used by individuals, households, businesses, and other organizations in Nepal. Energy drives key functions including cooking, heating, transportation, and electricity; all critical to economic activities, healthcare, education, and other foundational sectors.

Renewable Energy Companies

Renewable Energy Companies work with rural, semi-rural, and urban residents to install renewable energy systems such as solar panels and biogas plants. Qualified companies can access government subsidies, pro-rated according to system-capacity and location, on behalf of customers in order to reduce costs. Soft loans and interest-rate subsidies are also available. Increasingly, commercial enterprises are seeking to secure their energy access through alternative systems, predominantly solar. Although the government continues to expand and promote power generation external to the national electric grid, the energy incentive package requires annual approval and the subsidy program has yet to be reconfirmed this fiscal year. As of January 2016, the government has mandated a baseline for renewable energy production on all new development and construction. Renewable energy companies work both in Kathmandu as well as in villages to offer alternative energy products and systems for individual households, communities, and larger enterprises.

Trade Associations

Trade associations in solar and biogas energy form umbrella organizations for independent energy companies in Nepal. These trade organizations represent hundreds of companies and are responsible for providing training and capacity building to member companies, negotiating with the Government of Nepal, and facilitating engagement with international organizations and funders.

Black-Market Actors

The energy shortage has generated a thriving black-market trade in oil, petrol, cooking gas, and timber. Black-market actors are delivering energy needs through informal avenues, transporting high-demand goods from the Indian-Nepal border to Kathmandu and beyond for informal distribution. In Kathmandu, access to the black-market seems to be common knowledge including availability and price of commodities and enabled by mainstream social networks.

Nepal Alternative Energy Promotion Center

The Alternative Energy Promotion Center (AEPC) is a government organization with the mission of developing and promoting renewable and alternative energy technologies in Nepal. AEPC is also responsible for alternative energy policy, to include implementation and management of the government's alternative energy subsidy program. The center's primary focus is electrifying rural districts beyond the national grid; however, increased interest in renewable energy has contributed to growth in their urban program.

State Corporations (NOC, NTC, NEA)

Nepal's major energy providers are national corporations. The Nepal Oil Company (NOC) manages oil imports and distribution; the Nepal Timber Company harvests and distributes timber; and the Nepal Electric Authority manages hydropower production and the national electricity grid.

National Ministries

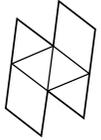
Multiple national ministries are responsible for setting policy and identifying and investing in Nepal's existing and potential energy infrastructure. The primary focus of the national energy agenda is expanding major hydropower to provide more capacity to the national grid.

National Government (Prime Minister's Office)

The Prime Minister's Office is responsible for negotiations with other countries regarding energy exchange and import. As a result of the unofficial blockade, the Prime Minister has engaged with China for the emergency provision of fuel and is working to establish the first ever trade agreement for the commercial import of petroleum products. The government continues to seek diplomatic resolution with internal protestors and normalize trade relations with India.

Local and International Aid Organizations

A mechanism for implementing energy alternatives.



OPPORTUNITIES

There are many opportunities, both incremental and expansive, for partners of the innovation lab to engage with and intervene in the energy sector in Nepal. The aim should be a more reliable and higher-capacity energy production and distribution system, less dependent on foreign imports and focused on sustainable, cleaner energy that contributes to national self-reliance and long-term resilience.

Expand Renewable Energy

Solar, biogas, and micro-hydro are all renewable energy solutions that have been implemented successfully in Nepal. These technologies are suited to urban and rural applications and if implemented as a package, could provide for household-level energy independence. These technologies should be integrated into new construction and earthquake reconstruction projects to support self-sufficiency for residents of those sites, contributing to a more resilient future. Furthermore, opportunities to improve or adapt these technologies to a local context should be considered.

Potential Local Partners: Energy Users, Energy Companies, Trade Associations, AEPC

Engage with Remote Communities

Delivering energy to remote communities enables a range of activities directly contributing to enhanced quality of life and improved health and safety, for example by providing connectivity to medical treatment, enabling small business economies, and powering household or community equipment such as water pumps and purification systems. Government agencies and energy companies have established a model for working with communities in remote districts and could serve as key partners in further developing a network to promote and share energy innovations.

Potential Partners: Energy Users, Energy Companies, Trade Associations

Co-Fund Renewable Energy with Government

Historically, the government has incentivized the installation of renewable energy systems with subsidy programs. These programs could offset the cost of installation of new energy technologies as facilitated by local and international partners, enabling programs to reach more beneficiaries.

Potential Partners: Energy Users, Energy Companies, Trade Associations, AEPC, Aid Organizations

Utilize and Build on Black-Market Networks

The black-market supply-chain that has developed in response to the blockade within Nepal represents an impressive network linking urban centers and remote regions into a new cross-national network. While the network will shift and dissipate once the border blockade ends, the scale of the network established in such a short time demonstrates the potential for building networks to distribute goods. Either through research or partnership, there may be opportunities to learn from black-markets established during the shortage for distributing innovations throughout the countries.

Potential Partners: Universities and Researchers, Black-Market Actors

Additional Opportunities

Develop New Energy Sources

Develop Carbon Offset as a National Enterprise

Develop More Durable Energy Technologies to Reduce Maintenance

Develop Training Program to Apply Migrant Laborer Skills to Energy Sector

Develop Enterprise Opportunity Targeting Social Inclusion in Energy Sector

Develop Enterprise Opportunity to Apply Remittances to Energy Technologies

Incorporate Energy Curriculum in Education

Explore Energy Technology to Expand Storage Capacity

Adapt National Energy Use Patterns