Architecture project provides data to guide energy plans in Bhutan and beyond

Data on solar water heating could help guide sustainable building design in Bhutan and provide lessons for neighbouring countries

Deependra Pourel is a Bhutanese architect from the small capital city of Thimphu in the western central part of Bhutan. The city has a population of about 100,000; the total population of Bhutan as a whole is less than one million.

Solar collectors being installed on the roof of a hotel in Bhutan

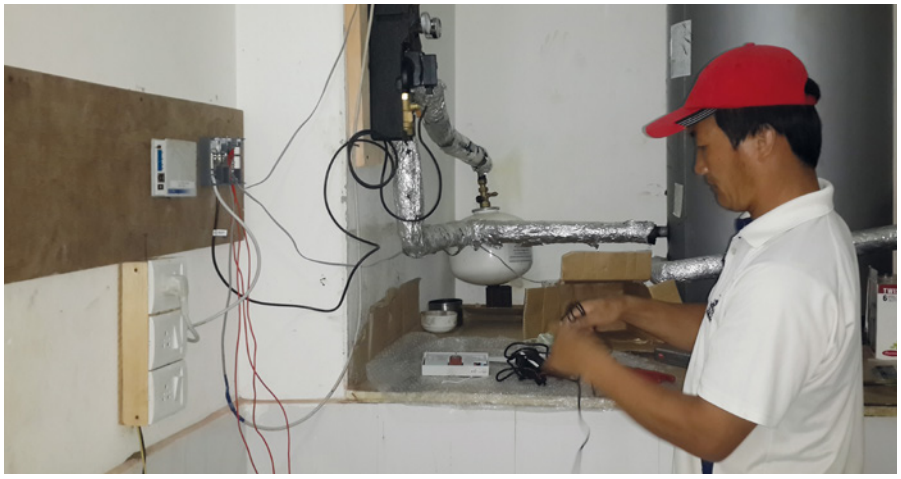
In 2013, Deependra took his first trip outside the small, land-locked, mountain country and travelled to Mozambique for a training workshop on Green Growth. It was this exposure, he says, that shifted his perception and has since driven his desire to incorporate environmental sustainability into architectural design and building. He is now committed to increasing his expertise and to working with his fellow countrymen and international colleagues to look at environmental solutions and sustainable innovations in architecture and buildings.

Following this, to equip himself with in-depth knowledge in the subject, he worked with international non-governmental agencies such as the Asia Society for Social Improvement and Sustainable Transformation, Philippines and the Centre for Appropriate Technology, Austria on an EU-funded project; Sustainable and Efficient Industrial Development (SEID), as a Technical Expert from 2013-2015.

Last year – in 2015 - Deependra took part in an AuthorAID research-writing course hosted by INASP. He is now embarking on a masters' degree in Architecture and Environmental Design at the University of Westminster in the UK.

"I have only recently realized the importance of evidence and research (that underpins architectural decisions). The problem is that in Bhutan there is a sense that the experts are from abroad rather than from within and it is difficult to be taken seriously – I need to expand my international education to take my passion forward," he explains.

"Bhutan is relatively new to the idea of research and very much so when it comes to the integration of energy and architecture. It is also important to understand the difference between carrying out research for education and doing active research in the field. We have only a few PhD holders of whom not many are active researchers at work. Research requires constant updating and



Wiring the solar water heating; data from the output of this project can provide insight for other sustainable-energy building designs

application in the field to realize the potential or at least try it; I feel that is what we lack," he continues.

Thirty years ago, Bhutan saw an opportunity to move away from an agriculture-based economy by harnessing its fast-flowing rivers and mountainous gullies to produce valuable hydroelectricity. Bhutan exports roughly 75% of its hydroelectricity to its energy-hungry neighbour, India. In 2015, Bhutan received Nu. 632.27 million (around £7 million) from India for this energy.[1]

However, uncertainties around climate change and its impact on Himalayan glaciers are adding to current concerns over the future of hydropower production and whether there are risks with the country having a narrow energy focus. Ultimately, with hydropower, full capacity can only be realized in summer. In contrast, in winter, given the volume of water, less energy is generated, requiring buy back of energy from India at a higher cost. The search for alternative sources of renewable energy such as solar and wind power has therefore become a priority.

In 2015, while working for the SEID project, Deependra seized the opportunity to test the practicality of a solar water heater in the kitchens of the Tenzinling Hotel in Paro, which is home to Bhutan's only international airport. The project was designed to pilot solar water heating use in the burgeoning tourism sector for potential roll out across the country. Bhutan is blessed with high solar irradiance, meaning it is very suitable for harnessing solar energy for heating purposes.

While the installation and the pilot test were a success and the system design was in accordance with the volume of hot water required, there was complaint of a shortage of hot water. To address the problem, Deependra and his team ran an on-site study and studied the data being generated. The team concluded that the problem was partly due to the usage pattern; all the washing up was piled up to be done at one time. It was also due to the type of plumbing fixture in place, where the tap measured a flow rate of 20 litres per minute. A schedule was therefore developed to stagger the chores while the tap was replaced. Additionally, the hotel management was advised to use the three sinks in an efficient manner to reduce water usage. Under the new system the first sink is filled with hot water and plugged for pre-rinsing to remove grease from plates and pots; the second sink is filled and plugged with soapy warm water for cleaning; and, finally, the third sink is used for final rinsing with

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warm water. This would reduce the water requirement by over 40% compared with the current practice of washing dishes under running water.

Deependra has also successfully installed a solar tubular daylight system in Bhutan Agro Industries

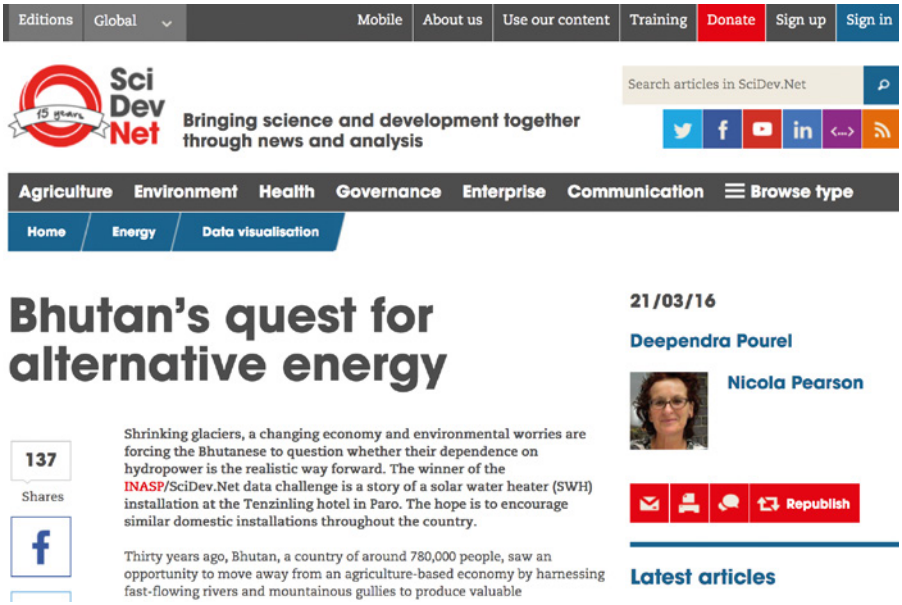
About AuthorAID online courses

INASP's AuthorAID project offers free open online courses in research and proposal writing. The six-week online courses, hosted on the free, open-source learning platform Moodle, are interactive and moderated, with peer-review exercises and discussion forums.

Topics include:

- Literature reviews
- Publishing ethics
- Writing your paper
- Getting published in a journal
- How to write a grant proposal

The courses have attracted up to 1,600 researchers from over 79 countries. The courses are particularly popular with participants from Mexico, Kenya, Ghana, Sri Lanka and India but they have also attracted researchers from fragile and conflict states such as Somalia, Afghanistan, Syria and Yemen. The courses normally run twice a year, in May and October, and course dates are advertised on the AuthorAID website (www.authoraid.info).



Deependra worked with data journalists at SciDev.Net to share his datasets with a wider audience

Limited to reduce use of energy for lighting spaces.

Keen to expand exposure to his findings, Deepandra sent his datasets from this solar energy project to an INASP-inspired SciDev.Net competition. The datasets that he developed were visualized and published, reaching an average quarterly audience of 32 million viewers.[2]

Deependra also voluntarily supported a local vendor with a live demonstration of the working of a solar water heater at the "1st Green Exhibition 2016" held from 22 to 25 April 2016 at the Changlingmithang ground at Thimphu, Bhutan. He says that it was an eye opener for visitors and guests to see how well the system could perform.

Currently sending links to his dataset and his project outline to international architectural publications, Deependra remains committed and optimistic.

"I would love to share my findings and take it to the next level. I am a firm believer that a research-led intervention allows greater opportunities to arrive at solutions that can address the need of the planet in wider dimension.

"Sharing my research and getting feedback would immensely help me in my zeal to improve on the research topic and (enhance) my personal development plan to be an expert in the field of research pertaining to the built environment," he says.

References

1 BPC, Annual Report 2015. Retrieved from www.bpc.bt/wp-content/uploads/2016/06/Final-BPC-Report-2015.pdf 2 December 2016

2 Bhutan's quest for alternative energy, SciDev.Net, March 2016. Retrieved from www.scidev.net/global/energy/data-visualisation/bhutan-quest-for-alternative-energy.html 2 December 2016