

Exploiting Newton's law of gravity to store green energy



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Many power plants these days harness energies from solar radiation, wind, ocean waves, and other green sources. However, like many other innovations, these sources have downsides. We can generate abundant green power only when the sun shines or the wind blows or the waves roll.

What do we do when the skies become dark and winds and oceans are calm? How do we satisfy the requirements of our energy-ravenous society?

The solution to this predicament is based on the immutable Newtonian logic: "What goes up, must come down." It is the gravity battery that replicates the fabled story of Isaac Newton's falling apple, but reconfigured on a much larger scale – with a little twist.

When a colossal mass, such as a concrete block, is lifted to a greater height using surplus green energy, it is stored in the block as gravitational energy. Also known as potential energy, it is the energy stored in an object because of its elevated position relative to the ground. The greater the height is, the greater potential energy is. When the block is lowered, potential energy is converted into kinetic energy, which sets the turbine of a generator into motion, producing electricity.

Energy generated from gravity batteries is sustainable. Furthermore, they will store green energy when there is too much and release it into the grid when there is too little. Besides, the tremendous weight of the block coupled with its slow descent will create a huge amount of rotational force – or torque – in the generator, allowing it to deliver maximum power almost instantaneously.

Gravity batteries have some distinct advantages over other batteries, such as lithium ion or nickel-cadmium batteries that lose



SOURCE: ENERGY VAULT

This 'starfish' tower in Ticino, Switzerland stores and releases energy by raising and lowering massive blocks – gravity batteries (not shown).

their capacity to store energy in a few years. Consequently, they have a short lifetime, and recycling these batteries is difficult. Moreover, whereas mining the minerals – cobalt, lithium, manganese, nickel, cadmium and other rare earth elements – required for these batteries poses environmental problems and health-related risks for the miners, a block of iron needed for a gravity battery has a much lighter

environmental footprint.

Because gravity batteries are mechanical devices, they can break. For example, a cable can snap, or a winch can jam, or a patch of rust can appear in a metallic part. Though problematic, these issues are not beyond repair, because individual

components can be fixed or replaced with relative ease instead of replacing the entire system. So there is real scope for a gravity battery to have an operational life spanning a few decades.

Gravitricity Ltd, a UK-based green engineering company founded in 2011, is working to make gravity batteries a reality. The company successfully tested its first

prototype: an iron block weighing 50 tonnes, hoisted 15 metres up before gradually releasing it back, powering a series of electric generators with the downward gravitational force.

When fully operational, Gravitricity expects each battery to release between one megawatt

Electricity can be generated by raising the weights in the shaft, and then lowering them to activate a generator. Some researchers even came up with an unconventional yet ingenious idea of turning skyscrapers essentially into huge gravity batteries.

Gravitricity is exploring the possibility of having a battery consisting of 24 weights, each weighing 500 tonnes, for a total of 12,000 tonnes located down a shaft at a depth of at least 300 metres. Once operational, the battery with a 50-year design life is anticipated to generate 20MW of power with a maximum efficiency of 80 percent.

The idea of restoring abandoned

(MW) and 20MW at peak power for up to eight hours. According to their website, a 20MW power system "could power 63,000 homes for every hour that it discharges."

Gravitricity can also be deployed underground, leaving a significantly smaller surface footprint. They can be installed in abandoned mine shafts deep enough to house a full-sized battery.

Another gravity-based energy storage technique is called Pumped Storage Hydropower (PSH). It uses the force of gravity to produce electricity by funneling water uphill using surplus solar, wind or other green power, and then, when needed, forces it down to drive the electricity-generating turbine in a power station. Unlike conventional hydropower plants, PSH recycles the water. First used in the US in 1930, PSHs have a long life with minimal maintenance requirement and little ecological repercussions. PSH facilities can be found in many countries now.

The world needs bold and innovative climate solutions right now, particularly for storing green energy for later use. On this front, there may not be any silver bullets. But gravity batteries – with their harnessing of a truly infinite, omnipresent gravitational force – certainly have a role to play. The big question is: how soon will gravity batteries come to fruition?

An open letter to Bangladeshi youth

Imrul Islam is the outgoing advocacy manager for the Norwegian Refugee Council in Bangladesh.

IMRUL ISLAM

In a few short days, I will leave Bangladesh again. The first time I left, I left because I wanted to know more about the world and my place in it. A decade, a Master's degree, and a humanitarian mission later, I know there is still a lot more left to learn.

You might be wondering who I am to write you a letter. In a number of ways, I am no one special. I have not done much that is worthy of note, and have not won any awards you might know of. But I did grow up here and I know how the rain feels. I know the air and I know the dog that sits in the corner of my street. And so, perhaps foolishly, I feel like I can write to you. But I do have an ulterior motive, like all who write must.

For the past 18 months, I have worked for an international agency engaged in the Rohingya refugee response. I have been fortunate enough to learn from a community forced out of their homes, and in their plight, I have seen time and time again the urgency of fighting for our collective future. My note to you is a request to think of those deprived of what you and I can take for granted.

Right now, 4,000 Rohingyas are stuck in the "no man's land" between Bangladesh and Myanmar. While a small percentage compared to the one million who have found safety in Cox's Bazar, these 4,000 humans are victims of the same armed aggression, state brutality and global inaction that has defined generations of the Rohingya experience. Across an increasingly fractured world, conflict remains the primary driver of human displacement, and a reminder that things can break apart anytime, anywhere.

To make matters worse, when humans are forced to flee, they are met with barbed wires and the blunt ends of rifles. The richest states are the worst offenders, with pushbacks

and incarceration common across Europe and North America. Those who are lucky to find safety still face an uncertain future. Services, resources and compassion available to refugees vary greatly and, despite grand claims of equality, can often be traced over the colour of one's skin.

Climate change is causing this already flawed system to short-circuit. In northern Bangladesh, the floodwaters showed no signs of receding for a month; in southern Iraq, rivers as old as civilisation itself are drying up. This change, this radical shift, acts as both cause and correlation, precipitating and amplifying the need for people to move. We cannot stop this; we can only prepare for it.

What does this mean for Bangladesh,

As the waters rise, as cities become richer and towns become poorer, how do we ensure that humans are able to move to provide for themselves? How do we urge the privileged to share responsibility for the forgotten?

where one out of every seven people is projected to be displaced over the next few decades? One out of seven people can be someone we know, someone we love, someone we are willing to take on the world for.

I am plagued by a question that has no easy answer: as the waters rise, as cities become richer and towns become poorer, how do we ensure that humans are able to move to provide for themselves and their families? How do we do so sustainably, yet humanely, in a crowded and under-resourced country? How do we urge the privileged to share responsibility for the forgotten?

We are nowhere near where we need to be. Everything that will decide the future is up in the air: in Geneva, they are debating whether climate migrants are refugees; in Sylhet, they already are. These definitions matter because they are tied to responsibility and resources. Equally importantly, it matters who is part of these discussions – where they come from and what languages they speak.

Everyone agrees that responsibilities need to be shared, but no one agrees on how. Those who start wars, and those who contribute disproportionately to climate change, should theoretically shoulder more, but that is often not the case. We are trying to hold these feet to the fire, but to paraphrase a colleague, we need more hands.

Bangladesh, despite the great inequality that plagues it, is aware of the existential threat that faces everything we hold dear. But Bangladesh – and dare I say the world – needs you. You hold, in your anger and your compassion, the ability to bend the arc of our future towards justice. Your voices, in their unfiltered clarity and unbridled possibility, can inform and influence those with power over lives. Regardless of what others may tell you, you are in a position to inform. Everyone can read theory – only a few live it.

And so, when you think your words are not strong enough, make them stronger. When your critique doesn't raise enough brows, be more critical. Tell us, no holds barred, about everything we are doing wrong – about systemic change, about local leadership, about innovation and opportunity.

You don't have to be a humanitarian to do this work. On the contrary, those who do this for a living need reminders from those who want to live. Movements live and die with those who support them with their time and energy, with their rage and joy, with their art, their words, their stories about what is at stake: the rain, the air, the dog in the corner of the street we grew up in.

Government of the People's Republic of Bangladesh Ministry of Health and Family Welfare Health Services Division GNSPU, Health Economics Unit Ansari Bhaban, 14/2 Topkhana Road, Dhaka-1000 Website: www.heu.gov.bd Expression of Interest (EOI) For conducting the study titled "Gender differences in accessing and utilizing primary health care services in Bangladesh."	
1) Ministry/Division	Ministry of Health and Family Welfare
2) Agency	Gender, NGO and Stakeholder Participation (GNSP) Unit, Health Economics Unit, Health Services Division, MOHFW
3) Head of the Procuring Entity (HOPE)	Director General (Additional Secretary), Health Economics Unit and Line Director, HEF Operational Plan
4) Procuring Entity District	Dhaka
5) Type of Organization	Consulting Firm/Company/Organization licensed to undertake research/studies/surveys
6) EOI Ref. No and Date	Ref: 45.05.0000.009.31.002.19(Part-3) Dated 03.10.2022
Key Information	
7) Procurement Sub method	Quality and Cost Based Selection (OCBS)
Funding Information	
8) Budget and Source of Fund	GOB (Dev) Fund
Particular Information	
9) Project/Programme Name	Undertaking the Study titled "Gender differences in accessing and utilizing primary health care services in Bangladesh".
10) EOI closing date and time	24.10.2022 at 12 PM
11) Brief description of assignment	"In efforts to reduce gender and socioeconomic disparities in the health of populations, the provision of medical services alone is clearly short of being optimum. While socioeconomic development is assumed important in rectifying gender and socioeconomic inequities in health care access, the outcomes and empirical evidence of its impact is limited. GNSPU with technical and financial assistances from icddr, ls, and UNFPA Bangladesh, have undertaken a study to identify gender responsive indicators in health services delivery. By undertaking this study, GNSPU seeks to ascertain the health outcomes of primary health care system against a set of selected gender sensitive indicators across various district hospitals and Upazila health complex. The findings are expected to portray a current scenario of gender responsiveness of the primary health care system and also create an evidence base to design future interventions and strategic policies to enhance gender mainstreaming of the primary health care. Objectives 1. To understand the scopes and utilisation of urban primary health care services at district and Upazila level. 2. To unveil gender disaggregated barriers to accessing the primary health care services. 3. To find out scopes to promote gender responsiveness of the primary health care services.
12) Experience, resource and delivery capacity required	Minimum organizational requirement: The service provider shall be a Consulting Organization/Institution focused on the field of health care service and system having demonstrated expertise in evaluating Programmes or undertaking research. The applicant organization/institution i. Must be a registered Company/Firm/Organization. ii. Must have Tax Identification Number, Business Identification Number and up to date Income Tax Certificates (Submitted return), and not declared Bankrupt/Ineligible/Banned by the Court. iii. Must NOT bear any record of non-compliance with any Procuring Entity. Academic background of the team members: Team Lead i. Team lead must be a medical doctor with advance degree in Public Health. PhD would be of high preference. ii. At least 5 years' experience at national level in health systems research focusing on issues around gender in health. iii. Strong track record in qualitative assessments and conducting HH survey. iv. Demonstrated experience of working with Government, NGO, INGO, Development Partners especially in the area of health system strengthening. v. Previously engaged with the formulation process of national level policy/strategy document, evaluation of any national level health program. vi. Publications of Team Leader on health systems, gender in health as first author vii. Skills in facilitation of stakeholder engagement/workshops. Gender Specialist: i. Advanced level degree in Gender, preferably on Gender in Health ii. Strong track record in qualitative assessments and conducting HH survey. iii. Demonstrated experience of working with Government, NGO, INGO, Development Partners especially in the area of health system strengthening. iv. Previously engaged with the formulation process of national level policy/strategy document, evaluation of any national level health program. v. Publications on Gender in Health, as first author Statistician i. Advance level degree in statistics from any public university. ii. At least 3 years' experience of involvement as a team member of health systems research. iii. Experience in both qualitative and quantitative data analysis.
13) Other detail (if applicable)	Not applicable
14) Association with external firm	Association or consortium is accepted on the condition that the principal applicant MUST be a local firm/organization
15) Phasing of services	Not phased
16) Indicative start date (mm/yy)	Dec-22
17) Indicative Completion time (mm/yy)	Jun-23
Procuring entity details	
18) Name of official inviting EOI	Dr. Md. Enamul Haque
19) Designation of official inviting EOI	Director General (Additional Secretary), Health Economics Unit and Line Director, HEF Operational Plan
20) Contact details of the official inviting EOI	Ansari Bhaban (3rd Floor), 14/2 Topkhana Road, Dhaka-1000, Tel: +880 222 33 56820, Email: dg@heu.gov.bd
21) Detailed information available in the websites	www.heu.gov.bd, www.mohfw.gov.bd, www.cptu.gov.bd
The Procuring Entity Reserves the Right to Accept and/or Reject any/all EOIs	
Dr. Md. Enamul Haque Director General (Additional Secretary), Health Economics Unit, HSD & Line Director, HEF Operational Plan	