

WISIONS Webinar Series | Webinar 6 | 26.02.2019

How can open source technologies accelerate energy access for people off the grid?

Moderator: Molly Hurley Depret

Panelists:

- Vijay Bhopal, Connected Energy, Open Energy Access Alliance
- Martin Jaeger, Libre Solar, Open Energy Access Alliance
- Dan Frydman, Green Empowerment, Hydro Empowerment Network
- Luiz Villa, Wind Empowerment, University of Toulouse

WISIONS background What is WISIONS initiative about?



www.wisions.net

"WISIONS mission is

to **empower practitioners** and communities in the Global South to **transform** the production and use of **energy** so that it effectively **enables sustainable development**"





Practitioners of the **RedBioLAC** and **RedBioCol** have been contributing in advancing designs and applications of **low cost tubular biodigesters** in Latin America

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Some practitioners of **HPNet** have produced such **open source designs of pico hydro turbines**, published fabrication manual for free and organized trainings.





Most of the practitioners gathered within the **Wind Empowerment** Association have been advancing the application and improvement of **Hugh Piggott's open source turbine**.

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Practitioners of the **HPNet** have been advancing in the design of **open source load controllers** that better responds to the challenges they find in their micro-hydro projects.

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Practitioners of **Wind Empowerment Association** have been advancing the design of **open source modular power electronic components** that better responds to particularities of energy solutions based on small wind turbines.

Observations from WISIONS so far



Potentials

- > Open source concepts have been and are excellent drivers of innovation...
- > ... triggering creativity of and collaboration among diverse people
- > ... in some case led to new entrepreneurship

Challenges

- Knowledge and skills (and proper tools) are needed in order to take advantage of OS designs
- > While lot happens under a voluntary basis, resources (financial, material, political) are needed to maintain collaboration...
- > ... and to empower people to become involved

Where does the empowering potential of open source lays on?



"Only through a mix of craft, politics, and the support of social movements, will open [source] fully realise its potential to democratise technology."

Smith and Fressoli (2016): Can the open hardware revolution help to democratise technology?



Thank you very much for your attention !

http://www.wisions.net/pages/wisions-webinar-series



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LIBRE**SOLAR**



PRESENTOpenly Ambitious February 201

Reaching SDG7 ≠ Business as Usual

- Scale of SDG7 challenge is huge.
- Increasing demand that SDG7 is met largely through market means.
- Recent report Shell Foundation and Persistent:
 - Solar home system solutions only reached 1% of off-grid market, and estimated 2/3rd investment in off-grid to 4 companies.
- Question: How can 10 or 15 companies reach ~1bn people?
- Answer: They can't.

DECENTRALIZED RENEWAB THE KEY TO CLOSING THE ENERGY ACCES







Market Access is Issue #1

- 1000s of local companies are needed.
- 1000s of local companies need IoT technologies.



- [1] Rethinking IP protection.
- [2] Rethinking investment norms.
- [3] Enabling technology transfer.

	DECENTRALIZED RENEWABLE ENERGY (DRE) INDIA: GLOBAL LEADER IN ELECTRICITY ACCESS	
	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	9 MILLION ESTIMATED HOUSEHOLDS WITH DRE ELECTRICITY ACCESS
	304 MILLION DOTENTIAL NEW CUSTOMERS	862,000 JOBS BY 2020
	FASTEST-GROWING CLEAN ENERGY SECTOR	
	powerforall.org #endenergypovertyfaster	Powe ≩AL



An Open Source Alliance







Why Open Source?





The Process – in Practice

Example: IoT enabled Charge Controller











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Open-Source Technology Within the Micro-Hydro Community

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https://www.greenempowerment.org/



http://www.hpnet.org/

Introduction

A few terms for those new to Micro-Hydro Power:

- MHP -> Micro Hydro Power. A typical system looks like this.
- Electronic Load controllers (ELCs) regulate MHP systems to ensure the power generated is kept to a safe specification, protecting power generation equipment, consumers and their appliances.

HPNet at a glance:

- Multi country network consisting of private companies, suppliers, contractors, and organisations across the Asia region.
- Due to the size and diverse nature of the network, there a huge pool of knowledge and experience.
- To compliment this, HPNet maintains an online community and arranges topical discussions to mobilise the experience of the network in various working groups.



Examples of open-source within the MHP community





- Crossflow Turbine SKAT, Switzerland and BYS, Nepal
- Kaplan, Pelton, Crossflow Turbines and ELC -Remote Hydrolight, Afghanistan
- Concrete Turbine Casing Design -Janathakshan, Sri Lanka
- Hummingbird ELC Jan Portegijs
- MHPs generally An MHP system as an energy technology is, in my opinion, an excellent example of "open-source" because of all of the freely available materials which cover every aspect of an MHP project

Current projects with an OS nature

- Supported by the Wisions SEPS Grant
- Load Management Tools
 - Load Indicator Device
 - Simulation Tool
 - Workshop for load optimisation
- Electronic Load Controller (ELC)
 - Design resources
 - Build Manuals/Online Materials
 - Training/Knowledge Exchange
 Event











ELC Project

- ELCs were/are seen as a knowledge gap within the community based MHP organisations.
- After an ELC troubleshooting knowledge exchange, the need for a design and accompanying training materials was identified.
- So far the project has been supported by many, particularly EWB-UK, Sibat (Philippines), Tonibung (Malaysia), Green Empowerment (USA) and Wisions (Germany)
- Upcoming exchange event
 - Present a design to HPNet practitioners
 - Provide training in theory, manufacture, testing with a hands on and practical approach
 - Exchange ideas and aspects of other designs within the working group
 - Encourage the attendees to hold their own in country trainings to build further on local capacity
 - Encourage the attendees to experiment with the presented hardware platform for new feature development

Challenges

- Education
 - Safety
 - Encouragement
 - Skills
 - Explanation
- Access to funds for development
 - The organisations that want opensource tend to be the ones with the tightest budgets
 - Funding is generally for specific implementation projects
 - Time for engineers is normally devoted to project implementation



Benefits

- De-mystification
- Empowerment of local practitioners
 - Local production
 - Local maintenance
- Educational tools
 - Get people more involved in the technology, especially the younger minds of the communities
 - Transferrable skills for other opportunities
- Collaborative development
- Shared experiences
- Customization
- Market diversity
- Just because the design is open-source, it doesn't mean it can't also be a profit making product. Revenue can remain local.

Next Steps

- Feedback from the exchange
- Adding to available resources
- Engaging our working group to implement new features and other technology and build on them based on field experience.
- Securing funding to continue with the projects.
- With the advances in connected technology, it has become much easier to analyse the way these systems are used and to make them as effective as possible.
- The internet has also brought an almost limitless supply of educational resources which can be used to bring more people into the development community. You can find a YouTube tutorial on nearly anything!

Thank you



"How can open source technologies accelerate energy access for people off the grid?"

Some Theory from Academia and Practice from Wind Empowerment

> Associate Professor Luiz F. L. Villa University of Toulouse / LAAS-CNRS







About me



- Young Associate Professor in Electrical Engineering at the University of Toulouse
- Researcher in energy access, off-grid systems, modular power electronics and bottom-up open-source technology at LAAS-CNRS
- Active board member of Wind Empowerment





One billion

Geographic dispersion

Diversity of sources

Cultural diversity of uses









Energy Access – How it starts





Energy Access – How it starts





Energy Access – How it starts









Solutions are tier specific ...









... sometimes incompatible among themselves...

8650 3.7V 3400n

11 12 13 14 15 16



ECOMP



... and generate industrial dependence

Wind turbine manufacturers' share at the end of 2017

Siemens Gamesa Renewable Energy 10 GW / 2.647 turbines MHI Vesta Offshore Wind 2.9 GW / 918 turbines 1.2 GW / 206 turbines Senvion 1 GW / 202 tubrines Adwen Others 0.4 GW / 29 tubrines Market Share of Photovoltaic Cells 60% TOP 4 REPRESENTS 50% OF TURBINES CONNECTED Market share 30% 50% China Taiwan Japan Malaysia Germany Source: WindEurope United States 100% 90% Percentage of Global Shipments 10% 80% 70% 0% 60% 1995 2000 2005 2010 2015 50% Year 40% 30% 20% 10% WISIONS Webinar 0% 2010 2011 2012 2013 2014 2015 1H 2016 20+ 11-20 6-10 1-5



Maintenance becomes replacement ...







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... local practitioners become retailers ...







and technology access becomes an obstacle to energy access







How can energy access affordable and sustainable ?



What is "affordable" or "sustainable"?





What is "affordable" or "sustainable"?

$LCOE = \frac{\sum_{n=1}^{N} (Cap + Op + M)_{n}}{\sum_{n=1}^{N} E_{n}} \frac{\frac{Legend}{n = step in the period}}{\sum_{n=1}^{N} E_{n}}$



What is "affordable" or "sustainable"?





How can energy access be provided with the lowest long-term cost and highest long-term energy production?





How can open-source licensing lower long-term costs ?



Open-source potential





Development



Education



Plan

Maintenance



Installation





Social-economic potential



Maintenance



Development E



Education





Operation

Plan



Installation



Technical potential





The Piggot Turbine example





What is W.E. doing?







Maintenance Manual





What are W.E. members doing?







Multi-function Power converters



Multi-function Power converters









What are W.E. members doing?





2017 – Eval loggers project

2018 – SPEARHEAD project







There's potential.

The **knowledge database** is a key element to be considered

The State is a historical actor that MUST participate in the process

Universities could be a neutral power broker in the process