

Workshop Output WS 3.1.E

Title of workshop: **Renewable Energy: Impacts on Mountain Environments and People**

Prepared by

Moderators	Astrid Björnsen Gurung, Elke Kellner, Michael Lehning
Participants*	Marc Landry mdlandr1@uno.edu Gottfried Goekler gottfried.goekler@illwerke.at Elke Kellner elke.kellner@wsl.ch , elke.kellner@giub.unibe.ch Boris Salak boris.salak@wsl.ch Michael Lehning (2 inputs) lehning@slf.ch Gerhard Kopeinig info@benedikter.biz , arch@archmore.cc Poster: Valentino Carlo Luigi Piana valentino.piana@hevs.ch Matthieu Barril matthieu.barril@univ-smb.fr

* Workshop participants that have submitted contributions to the workshop

General questions to please be answered in the workshop reporting

- 1) What was the focus of the workshop? Methodological issues and advancements or thematic issues (systems knowledge, transformation knowledge, target knowledge). Please check and fill in the matrix in the output section.

Project name	System Knowledge	Transformation Knowledge	Target Knowledge
Europe's Battery: A history of hydropower development in the Alps, 1850 to the present. <i>Marc Landry</i>	x		
Alpine Hydropower: Enabler of the energy transition <i>Gottfried Goekler</i>	x		
Floating PV in mountain artificial lakes: a sustainable contribution? <i>Valentino C.L. Piana</i>	x (see 1)	x (see 2)	x (see 3)
Social acceptance of the planned dam Trift in a valuable landscape in the Swiss Alps <i>Elke Kellner</i>	x	(x)	
Hands off the Alps? Choice experiment on peoples' preferences on landscape developments through new renewable energy infrastructures in Swiss Alpine landscapes <i>Boris Salak</i>	(x)		x
How can socio-environmental resilience of high-altitude hydropower system be read in the landscape? <i>Matthieu Barril</i>	x		(x)
Wind energy potential in complex alpine terrain <i>(Kruyt Bert), Michael Lehning</i>	x		(x)
PV production in snow covered mountains: benefits and risk <i>Michael Lehning</i>	x		(x)
Project Sinfonia: "Passeggiata dei Castani" <i>Gerhard Kopeinig</i>	(x)		x

- 2) Which key points were discussed in the workshop as a whole?

Efforts to reconstruct the energy system towards renewable energy offers opportunities as well as threats to mountain regions worldwide. The workshop brought together evidence for large

potentials for the production of renewable energy in mountain regions. Apart from well-established hydropower systems, mountains are often suitable for the production of wind energy, solar power (including floating PV panels) and bioenergy. However, it is unclear how and to what degree renewable resources provide benefit to the local development. Apart from energy provision, topics such as energy storage, ensuring system stability, energy-fairness, public preferences and acceptance are important to consider. History has shown that what is unthinkable today may be tomorrow's solution! Acceptance can evolve.

- 3) What is your opinion on the current state of knowledge concerning your topic(s) (focusing on mountain regions)? *Please check and fill in the matrix on the following page.*

Overall assessment of the state of:

What is your personal opinion on the current state of knowledge concerning the topic(s) addressed in your workshop. Please tick the appropriate field. Brief explanations are appreciated.

State of knowledge	Very good	Good	Poor	Very poor	Not appropriate	Comments
Global				x		
Regional		x				<i>Which region? Alps</i>
Scattered case study-based knowledge		x				<i>Where?</i>
Knowledge about past states/trends				x		
Knowledge about current situation			x			
Knowledge about future states/trends/thresholds			x			
Knowledge about the system			x			
Knowledge about shaping pathways to more sustainable development (transformation knowledge)			x			
Knowledge about envisaged goals (target knowledge)			x			

Ideas for questions to potentially be answered by the moderators after the workshop in the reporting (please delete what is not useful):

1) Were there any new insights and/or findings presented? If yes, which ones?

2) What was the main message/consensus of your workshop?

From a resource perspective, mountains are suitable “power stations” for the energy transition. With water, wind, sunshine and often ample forests, mountains could offer potential sites for power production and storage plants.

The development of new energy systems in and outside mountain systems will offer great development opportunities to mountain regions (e.g. enhancing energy security, income generation, achieving energy autonomy), yet may trigger unwanted impacts on the environment and add pressure on natural resources.

Access, energy-equity, ...

What seems impossible today, might be tomorrow's solution! (lesson from history and acceptance studies)

3) Were major uncertainty issues identified and discussed? If yes, which ones?

The largest uncertainty issue related to renewable energy in mountains is the joint impact of climate change and change of demand. As examples, the changing production patterns in hydro-energy due to precipitation shifts (from snow to rain) and demand shifts (from heating to cooling) are already visible today and will continue to change in future. Changes in solar PV or wind appear less problematic. Other uncertainties include the political (and therefore economic) boundary conditions and the construction of new infrastructure with the aim to replace nuclear or carbon-based energy production.

4) Was there any significant controversy (if so, what?) that requires new data (or further exploration of existing data) to resolve the issue? (explain)

The biggest controversy is on balancing renewable energy construction versus other environmental aspects such as ecological problems of wind installations (birds) or the use of untouched landscapes for PV installations (or wind). Similar problems evolve around new hydropower installations. A further controversy is on subsidies for renewable installations such as feed-in tariffs.

5) Were new research questions raised? If yes, would working on these questions need to involve other disciplines (which ones)?

6) Did the workshop identify research topics (e.g. environmental drivers other than climate) that are, in your opinion, currently greatly underrepresented in mountain research, but should urgently be addressed?

Further Comments