Outline of the presentation

• ICIMOD and Hindu Kush Himalaya
• RE and agriculture nexus
• RE Technologies – ICIMOD’s piloting on SPIPs
Among the world’s most important global resources, the HKH—Hindu Kush Himalaya—water tower for Asia
The pulse of the planet.
Water-energy-agriculture nexus
The multiple and competing uses for water, energy and food production mean there are important trade-offs that should be considered, often between sectors that are not coordinated.
Total Final Energy Consumption (TFEC) by Sector (2016)

- **Afghanistan**
  - TFEC = 133 PJ
  - Non-energy use: 18.2%
  - Agriculture, forestry, fishing: 45.9%
  - Other consumers: 36.1%

- **Bangladesh**
  - TFEC = 1,400 PJ
  - Industry: 28.7%
  - Commerce, public services: 31.3%
  - Transport: 10.8%

- **Bhutan**
  - TFEC = 65 PJ
  - Households: 77.7%

- **China**
  - TFEC = 75,919 PJ
  - Non-energy use: 16.7%
  - Agriculture, forestry, fishing: 49.5%
  - Other consumers: 33.7%

- **India**
  - TFEC = 26,661 PJ
  - Industry: 52.7%
  - Commerce, public services: 34.2%

- **Myanmar**
  - TFEC = 706 PJ
  - Non-energy use: 52.1%

- **Nepal**
  - TFEC = 529 PJ
  - Households: 78.1%

- **Pakistan**
  - TFEC = 2,808 PJ
  - Industry: 34.3%
  - Commerce, public services: 25.0%

Source: UN Statistics Division, Energy Statistics Year Book
Agriculture in Nepal – some facts

68% population derive livelihoods from agriculture

34% contribution to the GDP

4.6 million food-insecure people

40% children younger than five years of age are stunted

1.4 million malnourished pregnant and lactating women, & 48% suffer from anemia

Only 1.1 million of the 3.5 million hectares of cultivated land (31%) is irrigated

50% irrigation is through surface irrigation schemes which are mostly fed by small and medium-sized rivers – with high fluctuation in water volume

1.18 million ha of land that could be irrigated still supports only rainfed agriculture

Challenge is to feed more people with less land and more uncertain conditions
RETs for agriculture – scope for irrigation

Irrigated and potentially irrigated land (x1000 hectares)

Source: IMP, 2019

Cultivated agricultural land  | Potentially irrigated land  | Present irrigated land
--- | --- | ---
**Terai** | 1594 | 1480 | 866
**Hills** | 1566 | 627 | 178
**Mountains** | 401 | 159 | 41

**Land to be irrigated**
- Terai – 41%
- Hills – 71%
- Mountains – 74%

Annual recharge of ground water in the Terai is 8.8 BCM, but less than a quarter of this is currently extracted.

6.9 BCM groundwater could be used for irrigation.

On average 5000–10,000 m³/ha of water is required to cultivate cereal crops in South Asia.
Solar powered irrigation pumps
Research questions:
• Can SPIP replace traditional irrigation pumps in a clean & cost effective way
• What are impacts of SPIPs on livelihoods – farmers income, crop productivity, cropping pattern
• What are impacts of SPIPs adoption in atmospheric pollution

How and where?
• 3-pilots with institutional variation: 1) women farmers using small diesel pumps; 2) Cooperative using large diesel pumps, 3) Men using electric pumps
• Saptari district – largest area under vegetable production, widespread use of diesel pumps, least HHs level electrification among all terai district
Key findings

Comparative study of farmers who have adopted SPIPs and farmers who have not (but statistically similar to the former in all observable ways).

- SPIPs reduce reliance on electric and diesel pumps
- Replacement of diesel pumps reduced black carbon emissions
- Assured access to irrigation has increased crop diversification, nutrition, and incomes.
- SPIP has made it less physically intensive allowing woman farmers to operate it comfortably
- No risk of over abstraction - 1.4 BCM, from an estimated available balance of 6.9 BCM, could be pumped to irrigate in the Terai
Efficiency of solar powered pumps

A solar powered pump irrigates 3.7 hectares of land where seasonal vegetables are grown year round (Hardiya, Saptari)

On an average, the pump’s output is 80,000–90,000 litres per day.

On a sunny day, one-HP pump can discharge up to 16000 litres per hour and irrigate up to two and a half hectares of land.
Efficiency of SPIPs –
combination of water storage ponds, drip & sprinkle
Replication and out-scaling of SPIPs

Udayapur, Nepal
Passu and Moorkhon in Pakistan
Mobile SPIPs in Pakistan

Economic viability of SPIPs for apple orchard

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net present value of SPIP</td>
<td>21 million PKR</td>
</tr>
<tr>
<td>Internal rate of return</td>
<td>31%</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>4.96</td>
</tr>
<tr>
<td>Payback Period</td>
<td>10.92</td>
</tr>
</tbody>
</table>

https://lib.icimod.org/record/32565
RETs and Covid context
Changing energy needs & Covid-19 context

Rapid urbanization – aspirations of youths

Changing farming/business practices – towards mechanisation

Productive use to catalyse socio-economic development – green products
Productive use of energy – pathway to development

Small-scale energy projects can lead to productive uses, which result in positive outcomes/impacts for local living conditions.
Productive use of energy – cont...

The use of RETs for agricultural VC means

- More value-added activities (grinding, milling, drying, storage)
- Reduced post harvest losses by providing heat and power for food preservation (drying, chilling and freezing)
- Better processing to translate products into stronger domestic enterprises for crops, fruits and spices,.....quality consistency, precision
Moving beyond business as usual

- Competitive products (profit, market)
- Quality and consistency
- Food safety
- Nature – resource sustainability
Ecosystem to promote RETs for agriculture

Access to renewable energy and energy efficient solutions

Resilient enterprises

- **Entrepreneurial orientation**
  - Anticipate and plan for change
  - Innovative business development
  - Product diversification

- **Market orientation**
  - Improved productivity
  - Increased production
  - Business expansion
  - New (green) enterprise development

- **Profitability**
  - Improved return on investment

- **Contribution to local economy**
  - Increased household income, health benefits
  - Green job creation
  - Sustainable use of natural resources
  - Mitigation benefits

Skill development
Enabling policy
Partnerships
Finance
Infrastructure
Technology choice
Thank you

Protect the pulse.