LOCAL ENERGY PRODUCTION FOR LOCAL CONSUMPTION IN MOUNTAINOUS AREAS

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Farmers putting their own Archimedes Screw

A lot of Archimedes screw are used in farm of TOYAMA in 1930’s.

Farmers put their own Archimedes Screw in an irrigation canal to get power for farm works.

Two-wheeled cart by which the screw was carried can be seen in the back.

(RASEN-SUISHA(1990) Tanaka)
1930’s, ca. 10000 water turbines worked in TOYAMA

Distribution in Numbers of Water Turbines (1930)

The Wheels were Replaced to Electric Motors

Change in Numbers of Archimedes Screws, Water Turbines and Motors

11,730 All Water Turbines

2784台

(RASEN-SUISHA (1990) Tanaka)
Water Turbines Move into Decline

• **Irrigation canal renovation**
  – Concrete-covered canal with increased flow and velocity
  – Hard to set the turbines

• **Farm electrification processed**
  – The electrical appliances: easy to use and control
  – High transmission efficiency of power
  – Downslide of price in both electricity and motors

• **Performance of the water turbine face to the end**
  – Low torque and revolution: not sufficient to new farm machinery
  – Shorter life cycle

Important Changes Associated with Turbine Decline

<Problems>

• Almost electricity users take power by money
• Farmers also don’t know where the electricity originate from
  • Such a thing does not be cared.
  • Electricity supply is “affairs of other people”
  • The only thing which I can do is complaining.

The farmer who should be doing anything by himself became a "user" unawares!
### The 3rd Energy: Self-Sufficient Energy

<table>
<thead>
<tr>
<th>1) Commercially-Supplied Energy</th>
<th>Commercial Products, Buying and Selling Value replaced with money Used by the general public Convenience • Price • Enterprise • Profit • Efficiency • Competition • law of dominance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) Strategic Energy</td>
<td>National scale, Political measure Issue of urban side (This energy doesn’t have substance)</td>
</tr>
<tr>
<td>3) Self-sufficient Energy</td>
<td>Daily essentials Gift of nature, Symbiosis with nature Pleasure of Production Value, cannot be measured with money</td>
</tr>
</tbody>
</table>

### Energy Dual Path

This concept is to show the 2 paths in receiving energy, the second energy path being “self-sufficient energy.”

#### self-sufficient energy
- Renewable E.
- DIY
- Small sized
- Symbiotic
- Contentment
- Safe and Secure
  - Water power
  - Geo-thermal, Solar power,
  - Wind, Biomass
  - Fire wood
  - Energy saving

#### Commercially-supplied energy
- High performance
- High efficiency
- Large scale
- High quality
- High technology
- Convenience
  - Nuclear Power
  - Thermal plant
  - Large water power
  - Mega solar
  - Smart grid

「地産地消のエネルギー」（2011）Niitsuma
Water was conducted through a PVC pipe from an erosion control dam (Photo) in a mountain stream in Osawano area of Toyama city.
Flow rate of the stream: 30～50L/s

**Approaches Electricity Self-sufficient in a Farm Household**

**Arrangement of the System**

<table>
<thead>
<tr>
<th>Item</th>
<th>Spec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Turgo-impulse</td>
</tr>
<tr>
<td>E. Head</td>
<td>11.5</td>
</tr>
<tr>
<td>Q (L/s)</td>
<td>20</td>
</tr>
<tr>
<td>P (kW)</td>
<td>1.0</td>
</tr>
<tr>
<td>Efficiency</td>
<td>50%</td>
</tr>
<tr>
<td>Dia. (m)</td>
<td>4</td>
</tr>
<tr>
<td>P (W)</td>
<td>400</td>
</tr>
</tbody>
</table>
Supply and demand Pattern in a Week

Electricity Demand Pattern in 7 Days

Electricity Supply Pattern in 7 Days

Electric Control Diagram for Self-Sufficient

From GRID

Mr. HASHIMOTO’s House

Dummy Load

AC100V

Charge Control Unit

Charger 2

Self-Sufficient Energy System

Commerially-Supplied Energy System

AC100V

DC-AC Inverter (3kW)

Charger 1

Battery (12V*150Ah*10)

Turgo Impulse (1kW)

DC24V

Overshot Wheel (0.4kW)

AC200V
Some Changes are Occurred in Hashimoto-san

• Mr. Hashimoto (the farmer) started to operate the generation system by water ON/OFF
  – Mr. Hashimoto changed the pressure pipe and water valve to be able to start/stop by himself.
  – He operates it depending on the flow rate of the water.

• Mrs. Hashimoto became to ask electric things these days.
  – How much the electricity charged in our battery?
  – How is the maximum output in our generation system?

• The Electric Vehicle has been purchased by Mr. &Mrs. Hashimoto at last!
  – They bought Mini Cav-MiEV of MITSUBISHI.
  – Planning to use it by Micro-hydro Power
Energy Local Production for Local Consumption

• **Affluence and contentment are brought to the area by utilizing the resources of the area**
  – Scale of local production is always small, but it is important for keep the security of individual life.
  – Not only “local production and local consumption”
  – Commercial circulation is not denied

• **Safeguards system using Energy Dual Path concept**
  – Providing safe and secure energy to a private life
  – Self-sufficient energy path usually support daily life, and commercially-supplied energy acts as a safety-net of the energy

• **Supply by oneself, various benefits are enjoyable**
  – Knowledge and techniques are accumulated in the region and/or individuals
  – Creation of new jobs by which local resources and techniques are maintained
  – By using local natural energy, values are circulated in the region.
    • If you use fossil energy, huge amount of money is flow out to the other region.