Making Energy Affordable
UN Target: "Access to Energy" for all by 2030

• Lighting + phone charging ≠ "access"
  Need more than 2-10W solar lamps/kits

Possible "Access to Energy" package:

• Residential, mostly night-time needs:
  Lighting, phone charging, radio, fan and/or TV
• Community/business, mostly day-time needs:
  Refrigeration (especially for clinics), communications for market access, productive power for processing crops, carpentry, others?
  = "Tier 2+" service package
  = 75-150 kWh/year/house, or 25-50W/house
Current view of "access to energy" is still uncertain, and current thinking is based on tiers of services.

However, very focused on consumers / households

Does not account for
- clinic needs for health
- community mills
- school equipment, comms
- solar water pumping

and similar mostly community-scale needs.

Hence, "Tier 2+" suggested which includes these needs.
Opportunity of Productivity

Saving 1 hour per day for 250 million women globally that lack electricity

= 100 billion hours/year of productivity

= 50 million peoples' worth of 8-hour days

= entire workforce of the UK or France

by reducing time spent processing crops, fetching water and collecting firewood
Benefits of solar agro-processing

Staple crops
• Mechanized agro-processing reduces time spent on basic labour
• Saved time leads to more time spent in the fields increasing food security
• Saved time leads to non-agricultural income-generating opportunities
• Saved time can also increase parents' contribution to children's education
• Reduced expenditure on diesel, which dominate offgrid milling now

Cash crops
• Processing cash crops at the village level can earn more value for households
  (eg. coconut oil vs copra, edible rice vs unhulled)
• Saved time leads to more time in fields growing/harvesting, increasing income

*Agro-processing is commonly part of microhydro, grid and diesel rural electrification projects, but rarely part of solar electrification projects.*
Over 1 billion people lack electricity

15 crops make up 90% of all food consumed on the planet

3 crop groups make up 50-60% of all food consumed

- Rice
- Maize
- Wheat and other cereals (sorghum, millet, barley, rye, etc)

Other major crops are roots (cassava, yams, potato, taro) and in the Pacific, coconut

Meat is a larger food group for the rich than the poor. Chicken and pork dominate the rural meat markets of poor countries.
## Staple Crops of the World

<table>
<thead>
<tr>
<th>Rank</th>
<th>Crop</th>
<th>World production 2008 (metric tons)</th>
<th>Average world yield 2010 (tons per hectare)</th>
<th>Processing required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maize/Corn</td>
<td>823 million</td>
<td>5.1</td>
<td>thresh, grind, winnow</td>
</tr>
<tr>
<td>2</td>
<td>Wheat</td>
<td>690 million</td>
<td>3.1</td>
<td>thresh, grind, winnow</td>
</tr>
<tr>
<td>3</td>
<td>Rice</td>
<td>685 million</td>
<td>4.3</td>
<td>thresh, hull, winnow, (polish for white rice)</td>
</tr>
<tr>
<td>4</td>
<td>Potatoes</td>
<td>314 million</td>
<td>17.2</td>
<td>wash, peel</td>
</tr>
<tr>
<td>5</td>
<td>Cassava</td>
<td>233 million</td>
<td>12.5</td>
<td>peel, grate or slice</td>
</tr>
<tr>
<td>6</td>
<td>Soybeans</td>
<td>231 million</td>
<td>2.4</td>
<td>thresh, dry, clean, press</td>
</tr>
<tr>
<td>7</td>
<td>Sweet potatoes</td>
<td>110 million</td>
<td>13.5</td>
<td>peel, sometimes slice</td>
</tr>
<tr>
<td>8</td>
<td>Sorghum</td>
<td>66 million</td>
<td>1.5</td>
<td>thresh, grind, winnow</td>
</tr>
<tr>
<td>9</td>
<td>Yams</td>
<td>52 million</td>
<td>10.5</td>
<td>peel, sometimes grate peel</td>
</tr>
<tr>
<td>10</td>
<td>Plantain</td>
<td>34 million</td>
<td>6.3</td>
<td>peel</td>
</tr>
</tbody>
</table>

*Source: Staple food - Wikipedia, the free encyclopedia.htm*
threshing maize

pounding = grinding
corn/cassava or hulling rice

winnowing

grating cassava / yams

grinding flour

grating coconut
Diesel mills are rarely found in small villages of <50 households.

Many villagers travel 1-10 km to access a mill outside their village.

This can cost $0.20-$1.00 for the return trip, with a 25-50 kg bag.

The cost of milling is typically $0.02-0.05/kg or $0.50-2.00 per bag.

Thus, **travel can increase agro-processing costs for small villages by 50-100%** and so they tend to not use mills even if they could afford it the basic milling cost.

Small solar mills can reach these markets that diesel mills do not.
Case Study - Corn Shelling
Case Study - Flour Grinding
Case Study - Rice hulling
Case Study - Coconut Grating