



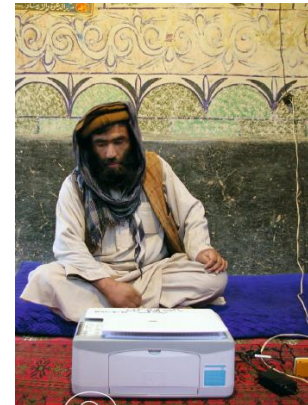
# Productive Uses of Energy

Experiences, publications, guidance and tools

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## What are Productive Uses of Energy (PUE)?

*PUE are defined as agricultural, commercial and industrial activities involving energy services as a direct input to the production of goods or provision of services. PUE...*

- ...includes home businesses, non-monetary income
- ...excludes social infrastructure etc.
- ...cuts across different sectors, energy sources, types of enterprises



## Why are PUE important?

**Productive use of energy can be a significant driver of economic growth and social progress in developing countries. PUE can...**

- ...underpin the creation and upgrading of value chains
- ...facilitate diversification of economic structures and livelihoods
- ...reduce vulnerability to multiple stresses and external shocks
- ...enhance the commercial viability and financial sustainability of infrastructure investments



## What does this mean in practice?

### Productive Uses of Energy can...

- ...convert into additional sources of income for end-users
- ...increase their ability to pay bills and recoup investment in grid connection/standalone systems as well as end-use equipment
- ...increase economic viability of mini-grids through higher load factors (particularly during daytime) and hence offer a baseload and higher revenues for operators
- ...increase the technical durability of energy infrastructure through an improved operator ability to cover O&M costs
- ...enhance impact of (rural) electrification



## What does GIZ offer in the PUE sector?

- **Advisory services and knowledge management**
- **Networking and international lobbying**
- **Tools and guidelines on...**
  - ...promoting PUE in energy access interventions
  - ...monitoring PUE impacts
  - ...specific technologies (e.g. DC Appliances, Solar Powered Irrigation Systems, Cooling)
  - ...and specific energy sources (Solar PV, Thermal Energy)



## **Publications and tools**

### *Part I: PUE promotion and business trainings*



# PRODUSE Manual

## A structured approach towards PUE promotion

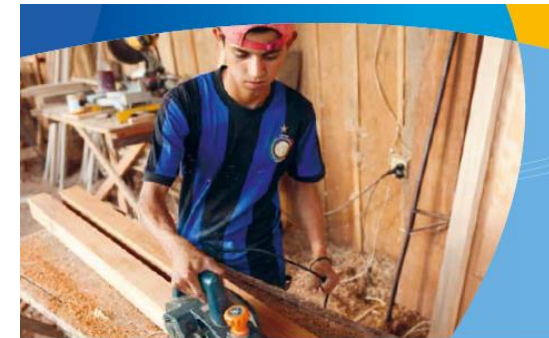
<http://produse.org/index.php?lang=eng&page=4>

### Objectives

- Pragmatic guidelines on how to plan, design & implement programmes for productive use promotion
- Structured approach applicable to a wide range of settings

### Assumed scenario

- To supplement ongoing (grid) electrification programme
- Headed by energy sector experts
- Target population is “electricity-illiterate”



Productive Use of Energy – PRODUSE  
A Manual for Electrification Practitioners



# Photovoltaics for Productive Use Applications

## A Catalogue of DC Appliances

[https://energypedia.info/images/9/98/GIZ\\_\(2016\)\\_Catalogue\\_PV\\_Appliances\\_for\\_Micro\\_Enterprises.pdf](https://energypedia.info/images/9/98/GIZ_(2016)_Catalogue_PV_Appliances_for_Micro_Enterprises.pdf)

- Catalogue with factsheets for DC appliances clustered according to the following categories:
  - Cold chain
  - Pumping
  - Milling, grinding, hulling, oil presses
  - Lighting and charging
  - Kitchen devices, hand tools for cottage and service industry, media & entertainment devices,
- Each factsheet includes technical specifications of the appliances and the required PV system and – if available – information on prices and costing
- Brief discussion on exemplary business cases and business planning.






# Mini Business Plan Calculator

[https://energypedia.info/wiki/File:PUE\\_Mini\\_Business\\_Plan\\_Calculator.xlsx](https://energypedia.info/wiki/File:PUE_Mini_Business_Plan_Calculator.xlsx)

## Review Sheet

This Review Sheet gives you an overview of the general technical and financial aspects of your future business. The results in this review can be changed.

Name of business:		0
Type of main products:		0
Type of main services:		0

### Technical and Financial Aspects



#### B Your business income

Scenario: Strong		0	\$/month	If your market is strong, your production will be high.
Scenario: Stable		0	\$/month	If your market is stable and your production is stable, your income will be stable.
Scenario: Weak		0	\$/month	If your market is weak and there is a recession, your income will be low.

#### C Your business expenditure

Total start-up expenses (excluding equipment):		-	\$	
Total monthly material and consumables expenses:		-	\$/month	
Total recurring monthly regular expenses:		-	\$/month	
Annual price increases:		0%	%/annum	The higher → the faster your expenses will increase.

#### D Your electric equipment

Total number of electric appliances:		0	qty	The higher → the larger the investment.
Total cost for electrical appliances:		-	\$	The higher → the larger the investment.
Total cost for solar PV System:		-	\$	The higher → the larger the investment.
Monthly savings for appliance maintenance and repairs:		-	\$/month	The higher → the more funds saved.
Monthly savings for solar PV System maintenance and repairs:		-	\$/month	The higher → the more funds saved.
Total power that all your appliances need is:		-	Watts	Maximum power, if all appliances are used at the same time.



# Publications and tools

## *Part II: Agricultural Applications*



# Solar Powered Irrigation Systems (SPIS): Study & Manual

<http://produse.org/index.php?lang=eng&page=9> (Forthcoming)

## SPIS Study

- Technology: The market can provide a suitable solution for almost any requirement or condition **but** a range of site-specific information is needed
- Economy: Cost-efficient and viable operation can be achieved **but** higher upfront investment costs pose a barrier
- Impacts: CO2 emissions and groundwater contamination can be reduced **but** risks (particularly groundwater depletion) need to be mitigated

## SPIS Manual

- Particularly SPIS involving drip irrigation pose a high challenge to farmers (due to dual innovation) and financial service providers – a capacity development manual is hence under development to assist in developing the skills to operate & finance SPIS

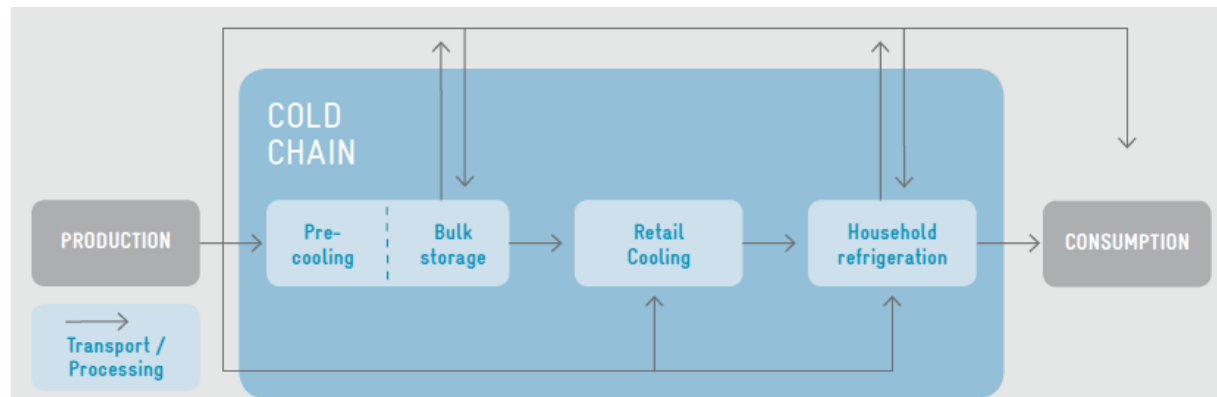


# Cold Chains for Perishable Food Products

<http://produse.org/index.php?lang=eng&page=9> (Forthcoming)

## Structure and Content

- **Contrast and compare cold chains** (set-up, organisation, actors for perishable food products in low- and high-income countries)
- Identify cooling needs along **three product categories** (fruits & vegetables, dairy, fish & meat)
- Summarise **technological options** for cooling and identify options for (renewable) **energy supply**
- **GIZ project examples**





## **Publications and tools**

### *Part III: Productive Use of Thermal Energy*



# Productive Use of Thermal Energy

## Overview of Technology Options and Approaches for Practitioners

<http://produse.org/index.php?lang=eng&page=15&gallery=34>

### Overview study on...

- ...existing technologies and conventional production processes in the agricultural, industrial and commercial sectors

### Technology examples for...

- ...cooking, baking, drying, smoking, cooling or heating





## **Publications and tools**

### *Part IV: Monitoring and evaluation*



## PRODUSE Methodology

<http://produse.org/index.php?lang=eng&page=6>

- Businesses that get electrified can per se be different to those that do not get electrified, simple comparison of these two groups can lead to invalid findings  
→ *Proper usage of statistical techniques necessary and sufficient size of sample*
- Methodological rigour is possible with small budget
- Development of a robust and sound evaluation method for energy interventions with a focus impacts on SMEs; incl. three modules
  - Short SME survey (Module a)
  - Extended and profound SME survey (Module b)
  - Anecdotal case studies (Module c)







## PRODUSE I (2013): Benin, Ghana, Uganda

<http://produse.org/index.php?lang=eng&page=5>

### Findings

- Businesses in service sector tend to get connected to the grid, take-up rates in manufacturing sector of rural areas were low
- Usage of electrical appliances low, electricity mostly used for lighting (exception study in Ghana)
- Electrification hardly translated into higher profits, instead could even reduce profitability (Benin)
- Electrification can lead to creation of businesses, which generate additional income, and attraction of larger enterprises to the area of electrification





## **Publications and tools**

### *Part V: Website and WIKI-based information platform*



# PRODUSE Website

<http://produse.org>

ABOUT

PRODUSE MANUAL

PRODUSE STUDY

METHODOLOGY

ENERGY SOURCES

PROJECTS

PICTURE GALLERY

LINKS

## Productive Use of Energy **PRODUSE**

*"For the most effective impact, energy access projects should adopt an integrated approach, which would include [...] entrepreneurial skills development, productive uses of energy for income generation and the facilitation of access to finance and markets."*

UNDP 2012

### The Manual

Step-by-step guidance for designing and implementing activities to promote productive use of energy in the context of electrification programmes. [Read more >](#)

### The Study

The impacts of electrification on small and micro businesses in Sub-Saharan Africa with case studies in Benin, Ghana and Uganda. [Read more >](#)

### The Methodology

The PRODUSE methodology allows for a robust but cost-effective evaluation of the productive use impacts of energy projects and programmes. [Read more >](#)



# Energypedia Portal on Productive Use

[https://energypedia.info/wiki/Portal:Productive\\_Use](https://energypedia.info/wiki/Portal:Productive_Use)

The screenshot shows the Energypedia website interface. At the top, there is a navigation bar with links for 'Community', 'About', 'Help', 'Contact', a user profile for 'Rammelt', 'My Wiki Workspaces', and a 'Log out' button. A search bar is located on the left side of the page. The main content area is titled 'Portal' and 'Discussion'. Below this, there are tabs for 'Productive Use Portal', 'Productive Use Group', and 'All Productive Use Articles'. The 'Productive Use Portal' tab is active, displaying a welcome message: 'Welcome to the Productive Use Portal'. Below the welcome message, there is a paragraph explaining that the portal provides an overview of articles related to productive energy use. To the left of this text is a small icon of two green gears. Below the paragraph, there are two columns of content. The first column is titled 'Overview on Productive Use' and lists three items: 'Productive Use of Electricity', 'Productive Use of Mechanical Energy', and 'Productive Use of Thermal Energy'. The second column is titled 'Climate Change and Productive Use' and lists three items: 'Lighting', 'Energy for Agriculture', and 'Solar Cooling'. Below these columns, there is a section titled 'Examples of Productive Use' which lists three items: 'Lighting', 'Energy for Agriculture', and 'Solar Drivinn'. On the right side of the page, there is a 'Subscribe to our Newsletter' form with an 'Email Address' input field and a 'Subscribe' button. Below the form is a link for 'Newsletter Archive'. On the left side of the page, there is a sidebar with the Energypedia logo and a list of navigation links: 'About energypedia', 'Technologies', 'Energy Use', and 'Cross Cutting Issues'. At the bottom of the sidebar, there are icons for search, print, and settings.

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Technologies

Energy Use

Cross Cutting Issues

Portal Discussion

Productive Use Portal Productive Use Group All Productive Use Articles

Edit Actions

Welcome to the Productive Use Portal

Productive Use The **productive use portal** provides an overview of the articles related to productive energy use on energypedia.

Overview on Productive Use

- Productive Use of Electricity
- Productive Use of Mechanical Energy
- Productive Use of Thermal Energy

Climate Change and Productive Use

Examples of Productive Use

- Lighting
- Energy for Agriculture
- Solar Cooling
- Solar Drivinn

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Energy Technologies and



## Publications and tools

### Tools for PUE promotion and business trainings

- [Productive use manual](#)
- [Catalogue of DC Driven Appliances for Productive Use](#)
- [PUE Mini Business Plan Calculator](#)

### Agricultural Applications

- Solar-Powered Irrigation Systems Study (forthcoming)
- Solar-Powered Irrigation Systems Manual & Tools (forthcoming)
- Cold Chains (forthcoming)

### Other energy sources

- [Productive Use of Thermal Energy Guide](#)

### Monitoring and Evaluation

- [PRODUSE I Impact Study \(Benin, Uganda, Ghana\)](#)
- [PRODUSE Impact Methodology](#)

### Website and WIKI-based information platform

- [PRODUSE website](#)
- [Energypedia Portal for Productive Use of Energy](#)

### Project examples

- [Productive Use in Indonesia Study](#) and [Youtube](#)



**Thank you.**

**Monika Rammelt & Caspar Priesemann**

Poverty-oriented basic energy services

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