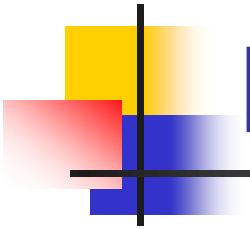
EN 653/PS 611
Energy Policy Analysis

Energy Access Tutorial
L6 (17th January 2019)



Framework

- Decisions
- Stakeholders
- Policies
- Goals
- Criteria
- Analysis

The data sheet enclosed provides the details of ‘a hypothetical un-electrified village in India. The village has 100 households with different income/expenditures (based on their Kerosene consumption). The village has some shops, flour mills, a school, a pump set for irrigation and a mobile tower. It is proposed to provide electricity access to the village.

The options being considered are:

i) Solar Home Systems

ii) Solar PV- Battery Micro grid

iii) Biomass Gasifier- Engine Micro grid

iv) Diesel Engine Micro grid

v) Grid extension

a) Compute the present energy used for lighting and motive power in the village. Determine the annual carbon dioxide emissions and the annual cost incurred by the village.

b) Compute the viability of solar home systems for the three different income classes. Would you recommend a subsidy on solar home systems? What would be a viable leasing model for Solar home systems?

c) Size, select and compare options ii) to v) for the village. Compute the tariffs without subsidy. Compare different policy interventions from the different stakeholder perspectives. Add/ modify the data sheet , as required (Include your sources)

Kerosene Lanterns

Lantern comparison

Light source (fuel)	Light output lumens (lm)	Fuel consumption	Efficacy (lm/W)	Initial cost (Rs.)
100 W bulb (electricity)	1340	100 W	13.4	400 (includes fitting & electrical connection)
Noorie (kerosine / diesel)	1300-1350	55-60 g/hr	2.03	450
Noorie (alcohol)	1350	90 g/hr of 93% (v/v)	2.82	550
Hurricane (kerosene)	68	16 g/hr (193 W)	0.35	100-150
Petromax (kerosene)	1300	80-90 g/hr (1025 W)	1.27	350-500
Fluorescent tube, 40 W (electricity)	2400	40 W	60.00	650 (includes fitting & electrical connection)

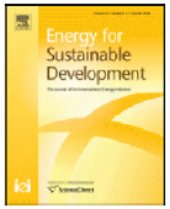
https://nariphaltan.org/lantern.htm

Lighting comparison

Energy for Sustainable Development 13 (2009) 271–279

Contents lists available at ScienceDirect

Energy for Sustainable Development



Evaluation of various energy devices for domestic lighting in India: Technology, economics and CO_2 emissions

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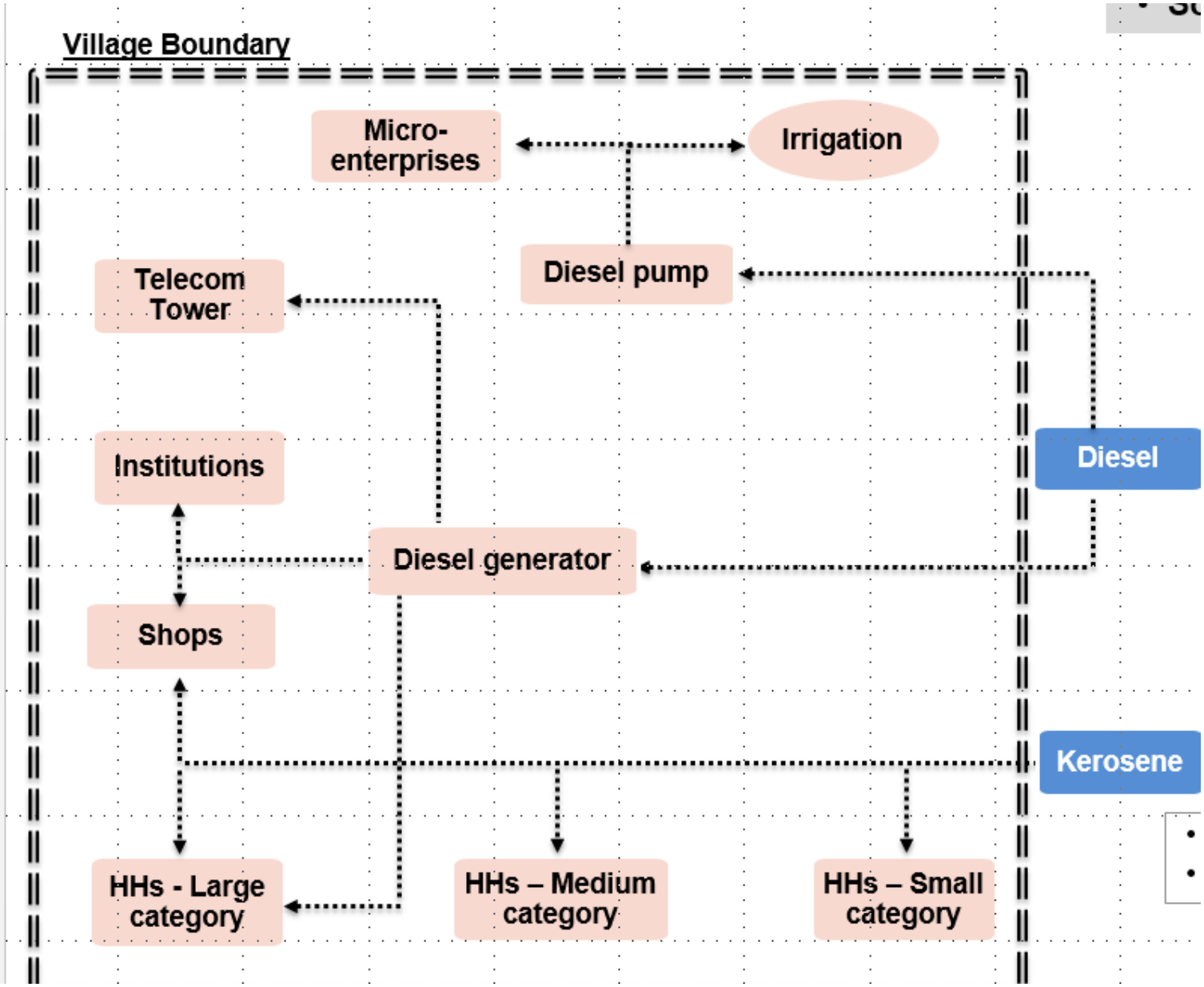
Kerosene lamp

	Kerosene wick lamp	Petromax	Noorie
Unit lamp cost (INR)	100	325	450
Annual maintenance cost (INR)	20	50	50
Fuel cost (INR/l)[a]	35	35	35
Life of the system (years)	5	5	5
Kerosene consumption (ml/h)	21.6	80	50
Lamp power rating (W)[b,c]	218	806	504
Light output (lumens)	76	1300	1250
Daily operational hours (h)	4	4	4

Kerosene properties

- Kerosene 11000 kcal/kg (GCV)
- Density 0.8g/cm^3
- 80% Carbon by weight

Assume complete consumption


Village Boundary
Micro-enterprises
Irrigation
Diesel pump
Telecom Tower
Institutions
Diesel
Diesel generator
Shops
Kerosene
HHs - Large category
HHs – Medium category
HHs – Small category

Input data

Capex		
Cost of Civil Work	RS	10000
Cost of Gasifier System	(Rs./kW)	63712
Cost of Gas Engine	(Rs./kW)	32274
Cost of battery bank	(Rs./kWh)	6500
Cost of converter	(Rs./kW)	16000
Cost of charge controller	(Rs./kWh)	350
Cost of Solar Panel	(Rs./kW)	35000
Cost of BoS	(Rs./kW)	20000
Cost of Diesel Generator	(Rs./kW)	15000
Cost of distribution network	(Rs./km)	125000

Equipment life

Parameter	Unit	Value
Gasifier Life	Years	10
Engine Life	Years	20
Battery Life	Years	5
Charge Controller Life	Years	10
Invertor Life	Years	10
Panel Life	Years	25
Civil Work Life	Years	35
Discount Rate	%	10%