

# Subsidy Rationalization for Missionary Electrification

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# Subsidy Rationalization

- Introduction
- $\text{Min UCME} = \text{TCGR} - \text{SAGR}$ 
  - Prod – PSA, hybridization
  - Focus on demand
  - ASEP TA's: supply
- Econ Theory: Cost recovery, equity, also sustainability
  - Graph
  - MC pricing vs AC pricing
  - Therefore, subsidy
  - If not subsidy then other schemes
- Regime 1 No subsidy
  - Types of tariff Uniform
    - IBT
    - Non-linear tariff
  - Country examples
- Method
- Regime 2 Subsidy

# Rural Electrification: Policy Trilemma

## 1. Cost Recovery

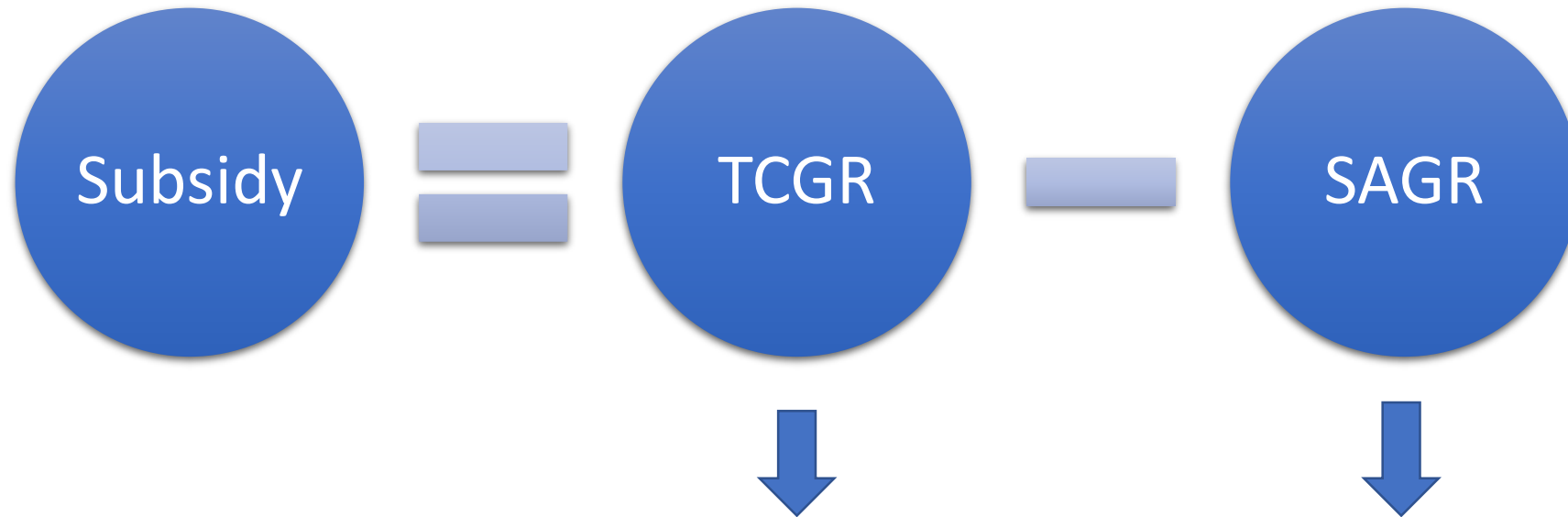
- Investment
- Ensure private sector participation

## 2. Energy access

- Universal electrification
- Equity

## 3. Sustainability

# Subsidy Rationalization: Components



Supply/ Production
<ul style="list-style-type: none"><li>• Least cost generation, sustainability</li><li>• Hybridization</li><li>• ASEP TA (Blechinger et al)</li><li>• CSP</li><li>• PSA</li></ul>

Demand/ Consumption
<ul style="list-style-type: none"><li>• Electricity tariffs</li><li>• Subsidy</li><li>• Demand elasticity</li><li>• Capacity to pay, household income</li><li>• Willingness to pay, preferences</li><li>• ASEP TA (Espos)</li></ul>

# Electricity Market



# Alternative tariff schemes

## Cost recovery (no subsidy)

### 1. Uniform pricing

- Differences in willingness and capacity to pay

### 2. Nonlinear pricing

- Takes into account heterogeneity in capacity to pay and willingness to pay
- Most common example: Increasing block tariff (IBT)
- Tariff classes based on:
  - Volume, consumption in kwh
  - Customer type: household, commercial, industrial
  - Metering: metered, unmetered
  - Geographic zone
  - Voltage level as measure of capacity: low, medium, high (Kv)
  - Time of use – different prices for different periods of day, week, year
    - Mitigates congestion, reflects capacity costs

# Alternative tariff schemes

## 3. Two-Part Tariff

- A fixed fee, regardless of consumption + plus a marginal cost price per unit

$$T(q) = A + Pq$$

- If consumers are homogeneous, then it would be optimal to set the two-part tariff with  $A^* = K/N$  and  $P^* = c$
- What is the optimal two-part tariff?
  - Efficiency such that no individuals/ consumers are excluded from the market
  - All pay price = marginal cost
  - Trade-off:
    - Efficiency losses because of exclusion of additional consumers when  $A$  raises
    - Consumption losses as  $P$  increases marginal cost
- Discriminatory two-part tariffs:
  - Quantity discounts
  - Multipart tariffs
  - Self selecting tariffs

# Comparison of tariff scheme

## **Flat Uniform Rate**

- **Advantages**
  - Simple
  - Acceptable to consumers
- **Disadvantages**
  - Less cost-reflective
  - Does not take into consideration consumer heterogeneity
    - Income: capacity to pay
    - Willingness to pay: quality of service

## **Non-linear**

- **Advantages**
  - Can be designed to balance multiple objectives of affordability, conservation, efficiency and cost recovery
- **Disadvantages**
  - Complex
  - Potential adverse consequences due to poor design or consumer understanding



# Increasing Block Tariffs: Italy

<b>Block</b>	<b>Size (kWh)</b>
6	4,441 and above
5	3,541 – 4,440
4	2,641 – 3,540
3	1,801 – 2,640
2	901 – 1,800
1	0 – 900

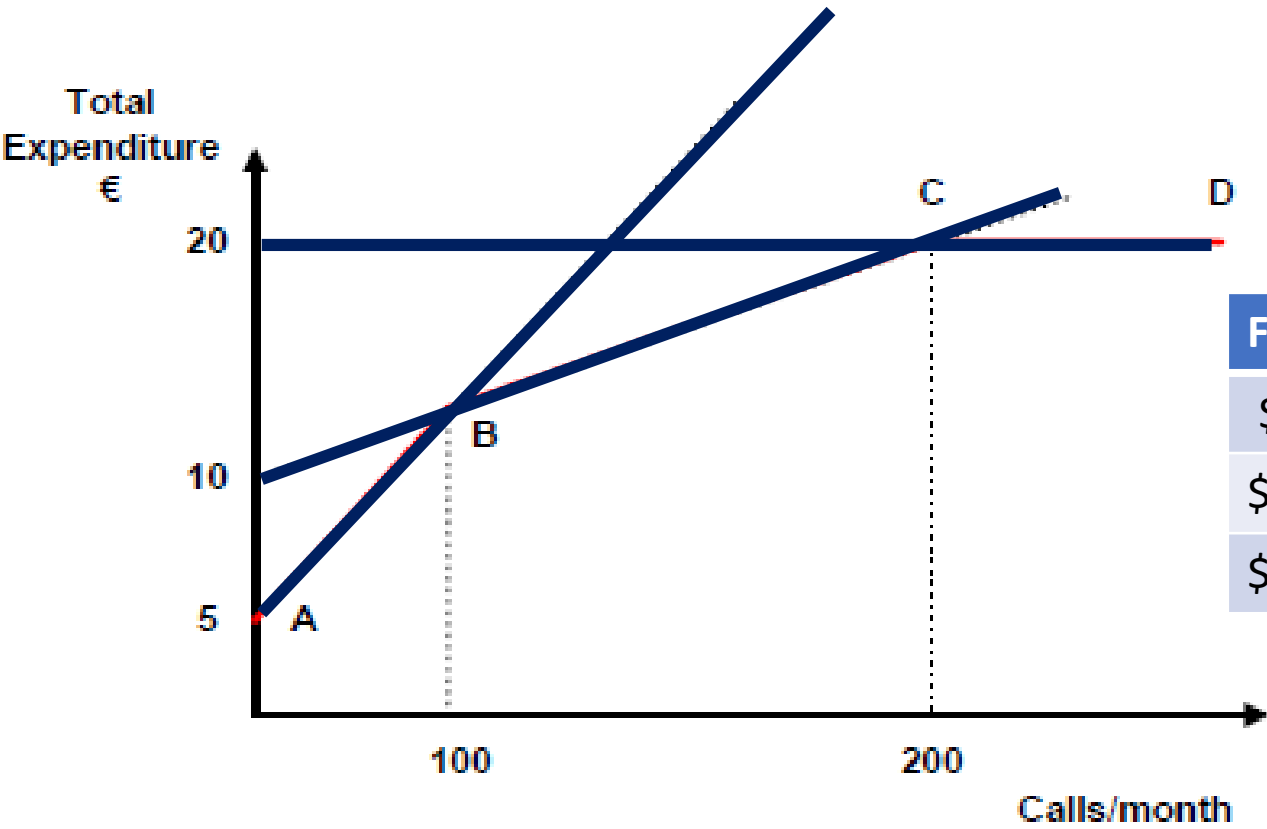
# Household residential tariff, selected countries

Case	Tariff component			Tariff charging basis	
	Fixed	Capacity	Volume (weight)	Non-linear	Time-of-Use
Italy	YES	YES	YES (66%)	YES	NO
Portugal	NO	YES	YES (62%)	NO	YES
Romania	NO	NO	YES (100%)	NO	NO
The Netherlands	YES	YES	NO (0%)	NO	NO
Norway	YES	NO	YES (70%)	NO	NO
California (PG&E)	YES	NO	YES (n/a)	YES	YES

Source: Lu and Price (2018)

# Example: Telecom

Two-part tariff self-selecting tariff with heterogenous consumer



Fixed Fee	Price/ Unit
\$5	10 cents
\$10	5 cents
\$20	0 cents

# Subsidy rationalization: some questions

- Who actually benefits from present subsidy scheme?
    - Subsidy incidence
  - Is subsidy needed?
    - Universal electrification, energy access
    - Cost recovery
  - How to design subsidy scheme such that the intended recipients benefit?
    - Targeting
      - Income
      - Electrified and unelectrified
    - Amount of subsidy
      - How to determine
- KEY: Classification of consumer groupings

# Data and Methodology: Rationalizing tariff and subsidy

- Evidence-based, versus ad hoc
- Analysis of electricity consumption/ demand side
- Use of microlevel data
  - Electricity consumption at the member-consumer/ household level
  - Income
  - Geographical and spatial characteristics
  - Other characteristics
- Statistical learning approach (big data), classical regression
- Key/ Main TA Output: Classification of consumers into clusters, groups as basis for rationalizing tariff and subsidy design
  - Can serve as basis for projections of subsidy requirement

End.

Thanks a lot!