Summary Stats on Electricity Consumption

Consumption Pattern of Residential Customers

Quick stats from billing data

Consumption (kWh/month)	2013	2014	2015	2016
10 th pctile	36.53	35.61	35.59	35.80
Median	107.64	109.02	112.05	116.79
Mean	169.87	164.31	169.86	177.91
90 th pctile	315.24	321.86	334.68	354.70
# meters (M./month)	13.7	14.14	14.48	14.76
# inactive (M./month)	1.43	1.53	1.62	1.73

*inactive meters are those that have <= 5 kWh consumption per month

Electricity consumption is right-skewed, with a lot of zeroes



Source: PEA billing data, February 2017

May has the highest average daily consumption, January has the lowest average daily consumption



Source: PEA billing data, January 2013 – February 2017



Top users: Phuket, Pathum Thani,

Chonburi (Phattaya)

[2013 - 2017, excluding q <= 5]

Median monthly consumption, averaged over Jan 2013 – Feb 2017

Zip code with largest median consumption in February 2017

Zip	Median q	District/Province
83150	362	ต.ป่าตอว ภูเก็ต
83100	272	ต.กะรน ภูเก็ต
84320	240	อ.เกาะสมุย า.สุราษฎร์ธานี
83130	201	อ.ราไวย า.ภูเก็ต
12150	196	อ.ลำลูกกา า.ปทุมธานี

Source: PEA billing data, February 2017

NE region has the largest fraction of inactive meters [2013-2017, counting those with q <= 5 units]

- Sri Saket, Ubon Ratchatani, Yasothon,
- Vacation home; Expat??, other explanations ?



Fraction of idle meters (q <= 5 units)

slightly increases over time and shows some seasonality



Source: PEA billing data, January 2013 – February 2017

Fraction of idle meters (q <= 5 units)

slightly increases over time and shows some seasonality



Source: PEA billing data, January 2013 – February 2017

What can Electricity Consumption tell us about Inequality ?

Average electricity use and payment in May is highly correlated with monthly household expenditure (from SES)



Each observation = province by month-year

Source: PEA billing data, May 2013-2015; NSO's SES 2013 -2015

Studies from the more developed countries show that electricity consumption is <u>more</u> equally distributed than income

- **United States** (Opower bill analysis study)
 - electricity consumption is <u>more</u> equally distributed than income because:
 - **1. Diminishing marginal utility**: "as a family's income increases, their electricity consumption is likely to grow less than proportionally."
 - 2. Energy efficiency investment among higher-income households
- **Canada** (Mirnezami 2014, "Electricity inequality in Canada"): Similar results

In Thailand, the top 10% households consume 40% of all the electricity with a Gini coefficient of 0.52



Source: PEA billing data February 2017, excluding q <= 5 kWh/month

"Inequality" based on electricity consumption

increases over time and is clearly seasonal



- Seasonality of the Gini reflects inequality in durable ownerships (mainly A/C)
- Thus, electricity consumption in the summer (Apr-May) is perhaps the best reflection of household wealth

Monthly electricity data shows a more unequal picture than the surveyed monthly household expenditure



Source: PEA billing data, May 2013; NSO's Poverty map data (2013)

Monthly electricity data shows a more unequal picture than the surveyed monthly household expenditure



Chiang Mai, Chonburi, Rayong, Phuket

Potential explanations on why electricity consumption is more unequal

- **Gini coefficient** = relative mean absolute difference
- NSO's survey data under-samples the high-income households (the right tail) → Underestimate inequality
- Electricity data includes all the high-income households, but also include tourism-related meters → Overestimate inequality

- Other explanations ?
- Further implications ?

Estimating Price Elasticity of Electricity Demand

Why do we care about elasticity ?

- **Price elasticity of electricity demand** is a crucial information for evaluating the effect and incidence of the following policies:
 - climate change policy
 - energy policy (e.g. price subsidy, cross-subsidy, demand-response measures)
- An estimate of the elasticity of electricity demand in Thailand currently does not exist

Empirical strategy to estimate elasticity

• Panel Data Regression with the following specification:

$$\log(q_{it}) = \beta_0 + \beta_1 \log(Ft_t) + \beta_2 \log(temp_{ct}) + \gamma_i + \epsilon_{it}$$

- q_{it} = average daily expenditure for meter *i* in month *t*
- Exploit exogenous changes in the Ft rates over time
- FE control for household-specific characteristics
- Time-trend control for time-varying unobserved factors that might correlate with consumption, e.g. income growth

- A **2% stratified random sample** by province and meter size
- Cover the period from January 2013 to October 2015
 - No change in electricity tariff schedule
 - The only price changes came from the adjustment to Ft rates
- Classify customers based on the size of meter:
 - Under 5(15)A \rightarrow small residential consumers who are eligible to receive free electricity if monthly consumption <= 50 units
 - Over 5(15)A \rightarrow larger residential consumers who are not eligible to receive free electricity

Variations in Ft over time



The impact of temperature on daily consumption



Elasticity estimates

		Log Daily Consumption				
	(1)	(2)	(3)	(4)	(5)	(6)
Variable	All Users	All Users	All Users	All Users	Over 5(15) Amp	Under 5(15) Amp
Monthly temperature	0.0442***	0.0440***	0.0441***	0.0443***	0.0563***	0.0393***
	(459.53)	(446.86)	(447.46)	(449.03)	(313.39)	(333.27)
log of Ft		-0.0294***	-0.0424***	-0.0413***	-0.0519***	-0.0329***
		(-11.38)	(-16.17)	(-15.72)	(-11.81)	(-10.07)
constant	-0.0929***	-0.0836***	-0.448***	-0.455***	1.489***	-1.533***
	(-34.95)	(-30.05)	(-34.88)	(-35.38)	(68.93)	(-96.06)
common time trend			Х			
province time trend				Х	Х	Х
N	8,156,987	8,156,987	8,156,987	8,156,987	2,825,879	5,331,108

t statistics in parentheses

* p<0.05, ** p<0.01, ***p<0.001

Area with the highest consumption has the highest elasticity w.r.t temperature



Heterogeneity in price elasticity



- Compare inequality between urban/rural areas
- Policy implications from the estimated elasticity
- Identifying tourism-related meters and potential SMEs
- Suggestions ?

NOT USED

How many units does a typical household need ?

้ำำนวนหน่วยต่อเดือนสำหรับผู้ใช้ไฟฟ้าบ้านอยู่อาศัยประเภท 1.1 ที่ใช้เท่าที่ำำเป็น (1,000 ครัวเรือนที่มีการใช้ไฟฟ้าต่ำกว่า 100 หน่วยต่อเดือน)

อุปกรณ์ไฟฟ้า	ำนวน	พลัมไฟฟ้า (วัตต์)	เวลาที่ใช้ / วัน/ อุปกรณ์*	Load Factor	หน่วย/ เดือน
หม้อหุมข้าว	1	450	0:30.00	1	6.75
กระติกต้มน้ำ	1	600	0:20.00	0.77	4.62
เตารีดไฟฟ้า	1	1,000	0:10.00	1	5.00
พัดลม	2	34	5:0.00	0.8	8.16
หลอดไฟตะเกียบ	4	6	2:0.00	1	1.44
โทรทัศน์สี	1	57	5:0.00	1	8.55
ตู้เย็น	1	58	24:0.00	0.6	25.06
รวม					59.58

์ ที่มา: โครมการศึกษาและทบทวนนโยบายและกลไกทางด้านราคาค่าไฟฟ้า เพื่อส่มเสริมการใช้ไฟฟ้าอย่ามมีประสิทธิภาพในระยะยาว โดย บริษัท เบอร์รา ำำกัด (เมษายน 2559)

Regions' Color Code



"Inequality" based on electricity consumption increases over time and is clearly seasonal



Source: Jan 2013 – Feb 2017 PEA billing data, excluding q <= 5

Per-meter consumption by Province

Average consumption, Residential



Average consumption, SGS



Average consumption, MGS



Average consumption, LGS

