ECONOMIC ANALYSIS OF GAS SUBSIDY REFORM AND FIT MECHANISM IN THE MALAYSIAN ELECTRICITY SECTOR BASED ON THE CGE MODEL

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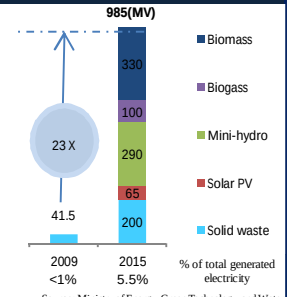
Motivation:

Electricity, Environment & the Economy:

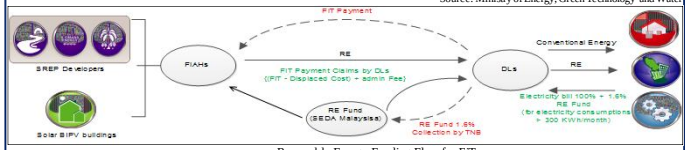
- The power sector in Malaysia benefits from the heavy subsidies provided for its gas inputs to keeping emission low.
- Subsidy disrupts the price mechanism and causes inefficient resource allocation.
- Power sector enjoys a price subsidy of about 73.3% while 32% of Malaysia's gas demand imports from abroad.
- At current consumption rates, gas reserves are estimated to last another 32 years.

Removing the gas subsidy without provision for alternative clean energy will result in gas being substituted with relatively cheaper coal that will increase CO2 emissions

- Moving towards RE replaces the need for fossil-fuel power plants.
- The FiT framework launched in 2011 may be Malaysia's best hope to see substantial development in the RE sector.
- Financing the RE fund is limited to only 1.6% of the total electricity bill.
- Renewable capacity by 2009 was less than 1% of the total installed capacity.
- Malaysia plans to achieve 985 MW or 5.5% share of renewable energy in the electricity generation mix by 2015.



Source: Ministry of Energy, Green Technology and Water



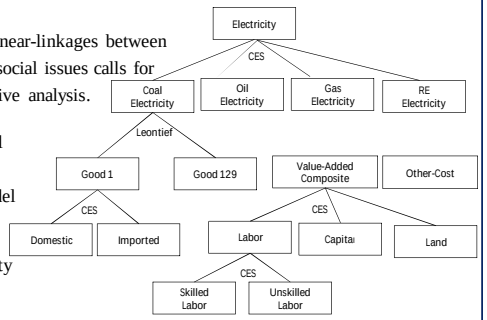
Renewable Energy Funding Flow for FiT

Source: Sustainable Energy Development Authority 2011, own drawing

Financing FiT framework by passing the cost only to electricity users is not effective enough to develop RE sources in the electricity sector

Methodology:

- The complexity of the linear-linkages between energy, economics and social issues calls for economy-wide quantitative analysis.
- A statistic multi-sectoral Computable General Equilibrium (CGE) model is constructed.
- A detailed electricity generation block:



- Captures the electricity sector which receives power from four energy types namely gas, coal, oil, and RE sources.
- Contains a special extension module for the promotion of electricity produced from renewable energy source under a FiT financing mechanism.

Energy subsidy reforms work...

...however, explore other options on the road to achieve sustainable development

Feed-in-Tariffs (FITs) could be effective

Data:

- 2010 Malaysia input-output (IO) table (Department of Statistics, 2014), some weaknesses:
  - Distinguishes between 124 different commodities and 124 different industries
  - Electricity and gas sector are aggregated into a single row
  - It does not distinguish between different types of the electricity sector
  - Actual natural gas subsidy data is not considered

Closure:

- The standard short-run closure is applied:
  Capital and land remain fixed; their prices will adjust in the face of any policy shocks
  Employment, is allowed to change, while the price of labor is fixed
  Aggregate investment, government consumption, and inventories are exogenous, while consumption and the trade balance are endogenous. Real household consumption is endogenous

An Electricity extended Input-output tables is constructed as the main database of the model

Main Results:

- Scenario I: Gas subsidies to power sector are completely removed (100% reduction);
- Scenario II: FiT policy through imposing a 1.6% sales tax on the household electricity consumption;
- Scenario III: Complete subsidy removal plus FiT policy.

Variables	Scenario 1	Scenario 2	Scenario 3
Real GDP	-0.02	-0.01	-0.01
Real public consumption	-0.02	-0.01	-0.01
Aggregate employment	-0.04	-0.02	-0.02
Real export volume	-0.02	-0.01	-0.02
Real import volume	-0.01	-0.01	-0.01
Consumer price index (CPI)	0.02	0.01	0.02
Terms of trade	0.01	0.003	0.004
Aggregate payment to labor	-0.22	-0.005	0.000
Aggregate payment to capital	-0.05	0.04	0.08
Aggregate payment to land	-0.01	-0.01	-0.01

- Removing a gas subsidy from the electricity generation sector would raise the price of electricity by 0.6%.
- A rise in price of electricity will lead to higher costs of production and hence contract economic activity: decrease in real GDP and total employment.
- The consumer price index (CPI) rises and depletes household welfare.
- The average price of exports in local currency terms increases due to the rise in domestic prices. As a result, the demand for Malaysian exports drops.
- The terms of trade increase.
- The small rise in payments to labour indicates that the increase in the nominal wage rate outweighs the decline in employment.
- When revenues are rechanneled into the economic system, the negative impacts on macroeconomic variables are mitigated.

Sectoral Effects:

An increase in production costs arising from the rise in input prices results in a reduction in the output of most of the non-electricity sectors

Sectors	Scenario 1		Scenario 2		Scenario 3	
	Output	price	Output	price	Output	price
ElecSupply	-0.23	0.60	0.25	0.44	0.20	0.54
ElecCoal	0.13	0.15	-0.26	-0.62	-0.25	-0.73
ElecOil	0.12	0.16	-0.24	-0.63	-0.23	-0.74
ElecGas	-0.27	0.35	-0.20	-0.65	-0.56	-0.58
ElecRE	0.08	0.17	5.27	-3.22	8.75	-4.85

- The 'electricity-coal' and 'electricity-oil' industries, as expected, show positive output (substitution effect)
- By producing electricity using renewable energy the emissions would be mitigated
- Applying the two scenarios simultaneously will result in a significant fall in fossil-fuel generation demand that could improve energy efficiency and emission reduction
- FiT policy modifies the production structure of the electricity sector with inter-fuel substitution making it less dependent on energy imports

Limitations & Further Research:

- Findings are consistent with bottom-up models
  → but more disaggregated renewable technology-specific level data could improve analysis
- What is the impact of RE electricity production on household welfare?
- What is the dynamic path of impacts?

Financing RE electricity production through any FiT support and accompanied by the provision of a gas subsidy will have a major impact in determining the contributions of the RE industry in electricity generation

Conclusion:

- ✓ First CGE analysis of gas subsidy reform and FiT policy in Malaysia
- ✓ Empirical evidence to support the FiT policy in Malaysia
- ✓ Results are consistent with significant contribution of RE in electricity production
- ✓ Necessity of reallocation of a provision of the gas subsidy as a complementary mechanism for RE electricity production to support financing for FiT.

Thank you.

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