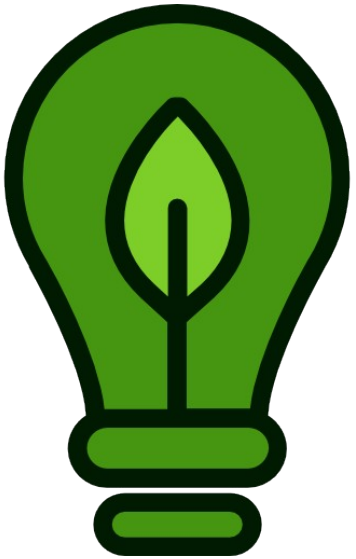
Proposal: Translational Research on Energy:

"Power to Gas" System using Electrolyzer & H2 FuelCells for UTM Campuses

@UTM DataCentre, *Pioneer* Site



Project Team Membership:

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Problems

1. **Too dependent on** single source of power supply

2. High electricity bill

3. Not using off-peak low tariff supply

Objectives

To convert the excess power to hydrogen fuel

To generate power during peak power demand

To shave the peak power demand to hydrogen gas/fuel

Uniqueness

Renewable Power & H2 Generation

Creation new industrial enterprises using hydrogen.

methodology

Gather the UTM campuses power system network data for power system study

Perform simulation on power system network

Determine the specification of the electrolyzer & fuel celss for the UTM campuses

Conduct testing at the pilot plants, monitoring system to monitor electrolyzer & hydrogen fuel cell operations

Executive summary

The Power to Gas (PtG) approach represents the Conversion of Power to Hydrogen using the electrolyzer. This method has been proven to improve the Power Distribution System by Utilizing Excess and/or Off-Peak Power. In addition, the converted hydrogen gas which virtually stored as energy and can be used to generate electricity via a fuel cell stack up to the required kW or MW capacity. In general, this approach helps in energy saving, provides energy security for data centre, and also creates new industrial enterprises using hydrogen.

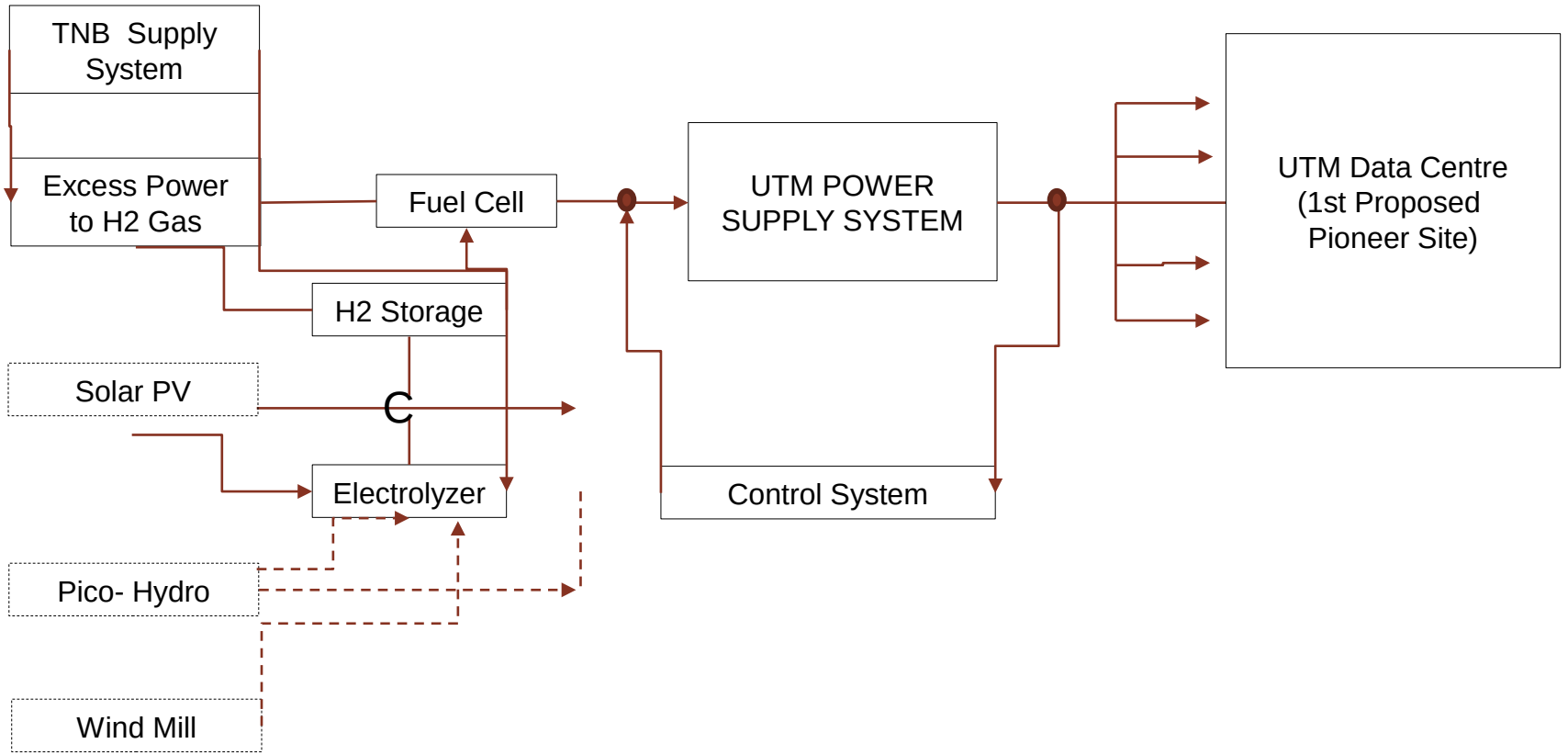

Figure 1. UTM Data Centre Energy System Configuration for Sustainability

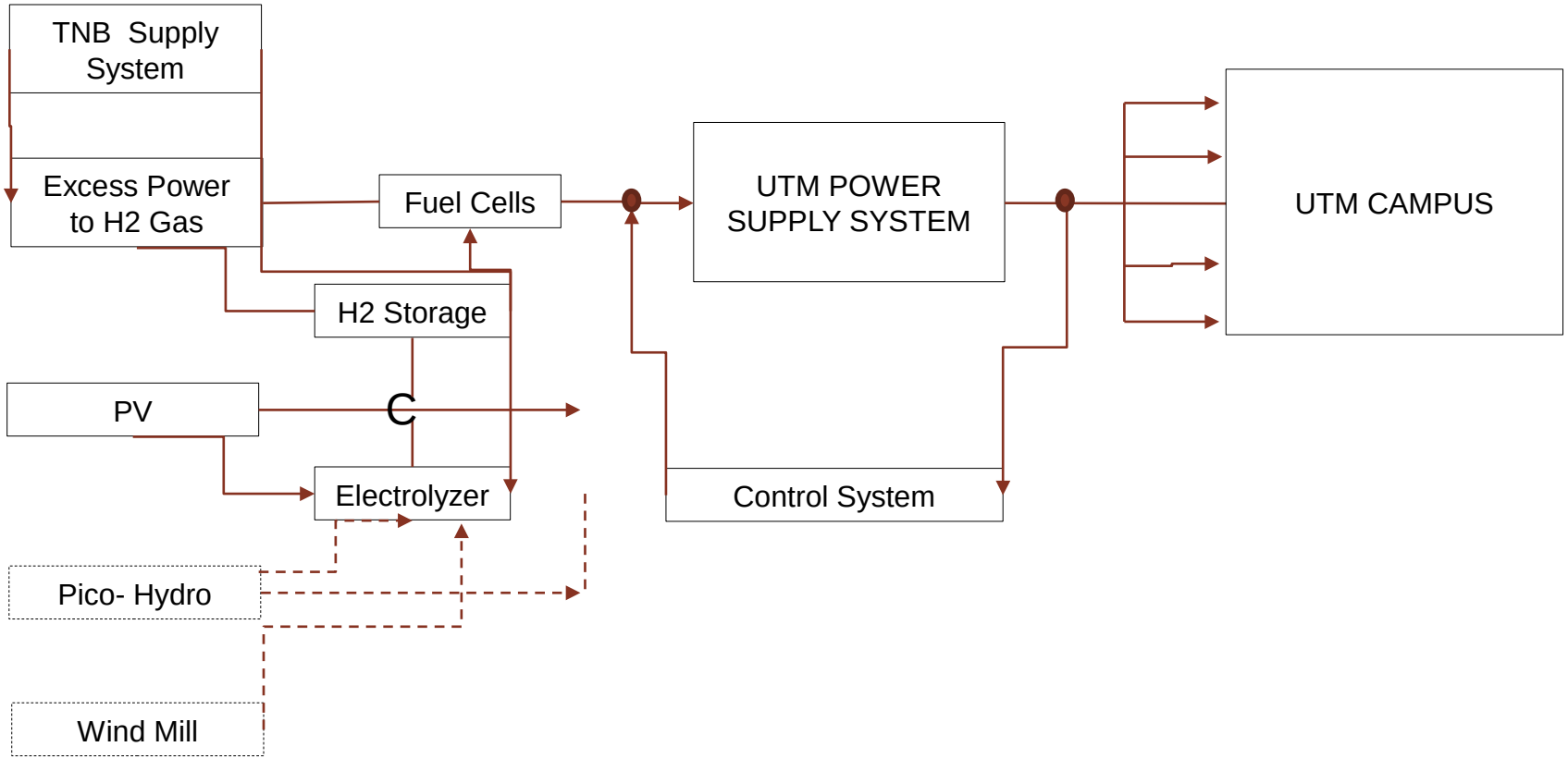

Figure 2. UTM Campus Energy System Configuration for Sustainability

Project Schedule

Activity	Mac	April	May	June	July	August	September
Gather the UTM campuses power system network data							
Perform simulation on power system network.							
Determine the specifications of the electrolyzer & H2FC for the UTM campuses							
Installation							
Conduct testing at the pilot plants, monitoring system to monitor electrolyzer & H2FC operations							
Launching							

Outcomes:

- 1 Unit PtG System
- 1 Patent
- 1 Indexed Paper
- RM5mil

EstimatED COSTS of ELECTROLYZERS BY CAPACITY

Actual specifications of the electrolyzer will be decided once the UTM data center loading has been identified. For this P2G project, electrolyzers utilizing PEM technology ranging from 500kW to 2MW are considered.

	(@) 500 kW	1 MW	(@) 2 MW
Nominal H2 Flow	100 Nm3/hr	250 Nm3/hr	400 Nm3/hr
H2 produced (kg)	9 kg/hr	22.5 kg/hr	36 kg/hr
* Estimated Price per kg	RM 67	RM 67	RM 67
(#) Market Value (Per Month) @80% capacity	RM 347,328	RM 868,320	RM 1,389,312

*Note: * - Hydrogen from natural gas (produced via steam reforming off-site and delivered by truck). Tax included.*
 # - Per Month (PM) = kg/h x Avg price x24 hrs x30 days x 0.8 capacity
@ - Actual manufacturer H2 generation specifications
1 kg is approximately equivalent to 11.111 Nm^3
It is estimated that 1kWh of electricity will generate 0.01538 to 0.01724 kg of hydrogen

	@500 kW	1 MW	2MW
H2 input (kg/hr)	9 kg/hr	22.5 kg/hr	36 kg/hr
Power Output (MWhr)			
Capital Cost (RM million)			
O&M (%)			
Generation Cost (RM/kWh)			