THE ROLE OF HIGHER EDUCATION IN MANAGING CONFLICT SITUATIONS IN SOCIETY FOR SUSTAINABLE DEVELOPMENT:
A CASE STUDY OF UMP’S CONTRIBUTION IN THE CONTROVERSIAL LYNAS RARE EARTH PROJECT

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5th April 2016
“...university's place as a paramount player in a global system increasingly driven by knowledge, information and ideas. Knowledge is replacing other resources as the main driver of economic growth and education has increasingly become the foundation for individual prosperity and social mobility.”
“...universities are unique communities within society; and therefore the university perpetually integrates with society, shaping its future.”
LYNAS Issues: ‘Big’ Questions

* Acceptance; to be developed (but not in my backyard?)
* Social, Economics & Politics (merits and interests?)
* Health, Safety & Environment (risks and concerns?)
INVESTMENT: MERITS & RISKS

- TECHNICAL
- FINANCIAL
- POLITICAL
- OPERATIONAL
- SOCIO ECONOMICS
INVESTMENT IN MALAYSIA

- systems and procedures in place;
- not as easy as several quarters claimed;
- All related agencies have their own respective rules and regulations;
- In LYNAS’s case, it took ~6 years before approval was secured.
Perception (or Politics?) vs Science

“Science may be vital, but the people with scientific knowledge seem less connected than ever to the people with power”

The Guardian (2012)

STEM CELL RESEARCH, BIRTH CONTROL AND GLOBAL WARMING

USA Today (2007)

ACID RAIN SCIENCE AND POLITICS IN JAPAN

Kenneth E. Wilkening (2011)

LYNAS (Gebeng) and RAPID (Pengerang)

Parliament Hansard on PSC Lynas (2012)
INTRODUCING RARE EARTH
ABOUT RARE EARTH MINERALS

ARE NOT REALLY RARE;

WIDELY SPREAD THROUGHOUT THE EARTH’S CRUST IN SMALL CONCENTRATIONS;

CANNOT BE MINED ECONOMICALLY.
Why Rare Earth?

Green Economy – Climate Change, Alternative and Conservative Energy

Strategic – “Middle East has Oil, China has Rare Earth” (Deng Xiao Peng 1987)

Human Capital Development – High Technology Experts
Rare Earths cannot be substituted in many applications

RARE EARTHS: LANTHINIDES PLUS YITTRIUM – UNIQUE PROPERTIES

- Chemical
  - Unique electron configuration
- Catalytic
  - Oxygen storage and release
- Magnetic
  - High magnetic anisotropy and large magnetic moment
- Optical
  - Fluorescence, high refractive index
- Electrical
  - High conductivity
- Metallurgical
  - Efficient hydrogen storage in rare earths alloys
Rare Earths underpin new materials technology required to sustain the needs of today's society

- Energy efficiency through lower consumption
  - Compact fluorescent lights
  - Hybrid vehicle
  - Weight reduction in cars

- Environmental protection through lower emissions
  - Wind turbine
  - Auto catalytic converter
  - Diesel additives

- Smaller yet more powerful digital technology
  - Flat panel displays
  - Disk drives
  - Digital cameras
Importance of REES to Modern Industry

- Medical Equipment
- Energy and Transport
- Aviation Industry
- Electronics Industry
- Aerospace Industry
- Information Technology
MARKET DEMAND: SALES OF RE

Global Demands: 180,000 metric tonnes

$ 3 BILLION

2010

$ 9.2 BILLION

2015

Commodity Online, 13th Dec 2011
 Rare Earth Demand

1. CERIUM
Flat-screen displays; fiber optics
Estimated 2015 demand in tons: 70,200

2. LANTHANUM
Oil refining; metal-hydride batteries for electric vehicles
Demand: 48,500

3. NEODYMIUM
Hybrid/electric vehicles; wind turbines
Demand: 36,900

4. YTTRIUM
Smartphones; flat-screen displays
Demand: 14,050

5. DYSPROSIUM
Magnetic resonance imaging; smartphones
Demand: 2,200

6. TERBIUM
Hybrid/electric vehicles; smartphones; flat-screen displays
Demand: 550
The world rare earth resource distribution
(USGS 2010)
The world rare earth supply in 2009 (USGS 2010)

- China: 94.23%
- Brazil: 0.47%
- US: 1.24%
- Estonia: 1.82%
- Malaysia: 0.28%
- India: 1.97%
The REE process involves the following steps:

1. **Crusher**: Ore is crushed into gravel size.
2. **Mill**: Gravel is milled into silt, and REE is extracted. Common minerals containing REE include bastnaesite, monazite, and xenotime.
3. **Separation Process**: REE is separated from the mineral.
4. **Oxide**: REE is first separated as an oxide.
5. **Metal**: Oxides are turned into metals.
6. **Alloy**: Metals are combined to create alloys.
7. **High tech applications**: There are hundreds of high tech applications for REE.

The process leads to high tech applications in various fields, including green energy, hybrid electric vehicles, water treatment, defense, and high tech.
CONTRIBUTING FACTORS
TO OPPOSITION OF THE PROJECT

- FUKUSHIMA TRAGEDY
- EXPERIENCE OF A.R.E BUKIT MERAH
- MISLEADING AND CONFUSION ON THE REAL ISSUE
COMPARISONS

A.R.E. BUKIT MERAH, PERAK
&
L.A.M.P. [LYNAS] GEBENG, PAHANG
A.R.E. BUKIT MERAH CHRONOLOGY
(based on Dr Meor Yusoff’s presentation captured in PSC Report)
23 Nov 1979 – ARE was incorporated, the company a joint venture between the Japanese (Mitsubishi Chemicals Ltd) and Malaysian (BEH minerals, Tabung Haji and individuals) investors to recover rare earth compounds from local monazite.
ASIAN RARE EARTH (ARE) - operating license

- Apr 1982 - ARE started its operation at 7.2 km Jalan Lahat in Bukit Merah Industrial Estate with initial license issued by Health Ministry.
- 8 Nov 1985 - Stop of operation order by the AELB as the company operate without license.
- 16 Jan 1987 - AELB issued a Class A license (interim operation) to the ARE
ARE: Public Protests

1984: residents of Papan and nearby towns sign a protest letter and send it to the Prime Minister, Perak Menteri Besar, the Minister of Health and the Minister of Science, Technology and Environment.

1986: Representatives from seven areas (Bukit Merah, Laht, Taman Badri Shah, Mengelembu, Papan, Badri Shah, Mengelembu, Papan, Falim and Guntong) form the Perak Anti-radioactive Committee (PARC).

1987: About 10,000 people participated in a rally condemning the ARE for its operation.
ARE – COURT CASES

- Feb 1985 – Residents of Bukit Merah sued the ARE claiming its operation endangered their life. The case was heard at the Ipoh High Court.
- 11 Jul 1992 – Ipoh High court issued order for the ARE to stop operation and transferred all wastes to the LTSF.
- 23 Dec 1993 – The Supreme Court overturned the High Court decision on 2 grounds. The Court was of the opinion that ARE's experts were more believable in terms of the results of the tests conducted by them showing that radiation was within permissible levels. Secondly, the Supreme Court said that the residents should have gone back to the AELB to ask that it revoke ARE's licence, because AELB has the power to do so under the Atomic Energy Licensing Act.
14 Jan 1994: ARE announce its closure; citing the low price of rare earth as the main reason.
LYNAS ADVANCED MATERIALS PLANT
[L.A.M.P]
LYNAS CORPORATION

- Mount Weld to Fremantle = 1000km
Gebeng, Malaysia, has exceptional infrastructure required for a Rare Earths separation facility.

**PROCESSING HUB WITH EXCEPTIONAL INFRASTRUCTURE**

**INDUSTRIAL INFRASTRUCTURE**
- Energy, chemicals, water, industrial land

**KNOWLEDGE INFRASTRUCTURE**
- Engineering, trade skills and services

**GOVERNMENT INFRASTRUCTURE**
- Including FDI incentives
  - (12 years tax exemption for pioneer status)
The products are set for Phase 1; Lynas has product flexibility in Phase 2

<table>
<thead>
<tr>
<th>PHASE 1 – 11,000t REO PRODUCTS</th>
<th>ANTICIPATED VOLUMES (tpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ce carbonate</td>
<td>2,600</td>
</tr>
<tr>
<td>La carbonate</td>
<td>1,350</td>
</tr>
<tr>
<td>Ce / La carbonate</td>
<td>4,000</td>
</tr>
<tr>
<td>Nd / Pr oxide</td>
<td>2,700</td>
</tr>
<tr>
<td>SEG + Heavy Rare Earths</td>
<td>480</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PHASE 2 – ADDITIONAL 11,000t REO PRODUCTS. Phase 2 will provide additional flexibility, with capacity to produce up to the following approximate volumes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ce carbonate, oxide</td>
</tr>
<tr>
<td>La carbonate, oxide</td>
</tr>
<tr>
<td>Nd oxide and Pr oxide</td>
</tr>
<tr>
<td>Separated SEG + Heavy Rare Earths</td>
</tr>
</tbody>
</table>
The Lynas Advanced Materials Plant (LAMP) is built to international environmental performance standards – gas, water and solids management.
BASIC FACTS vs MYTHS

Chemical plant vs nuclear power plant;

LYNAS, Gebeng is not the same as Asian Rare Earth, Bukit Merah;

Radioactivity of Raw Material (Mount Weld vs Bukit Merah) ~ 30 – 40 x
## COMPARISON ON RAW MATERIAL AND RESIDUES
### ASIAN RARE EARTH (ARE) VS LYNAS PLANT

<table>
<thead>
<tr>
<th>Plant</th>
<th>ARE</th>
<th>Lynas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral</td>
<td>Monazite</td>
<td>Carbonatites</td>
</tr>
<tr>
<td>Radioactive content</td>
<td>Uranium ppm</td>
<td>Thorium ppm</td>
</tr>
<tr>
<td></td>
<td>5,000</td>
<td>80,000</td>
</tr>
<tr>
<td>Residue</td>
<td>Thoria</td>
<td>Synthetic Gypsum</td>
</tr>
<tr>
<td>Radioactive content</td>
<td>Uranium ppm</td>
<td>Thorium ppm</td>
</tr>
<tr>
<td></td>
<td>7,000</td>
<td>360,000</td>
</tr>
</tbody>
</table>
BASIC FACTS vs MYTHS

Low socio economy benefits (~ 350 employees vs thousands employees)

Tax incentive (12 years vs typical 10 years)

Raw material and WLP (classified as low level NORM)
<table>
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<tr>
<th>BASIC FACTS vs MYTHS</th>
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<tbody>
<tr>
<td>Avoid building the plant in Australia and came to Malaysia (feasibility);</td>
</tr>
<tr>
<td>Chased out from China &amp; Terengganu (market control &amp; time);</td>
</tr>
<tr>
<td>WLP commercialization (6 Bq/g to 1 Bq/g → UK’s Health Protection Agency: road construction)</td>
</tr>
</tbody>
</table>
BASIC FACTS vs MYTHS

Radioactivity of Residue (Lynas vs ARE : 60x);

Radioactivity Rain from Stack (0.002 mSv/yr vs permissible 1 mSv/yr);

Traveling of Radon and Thoron gases (very short half life);
REPORT BY PARLIAMENT SELECT COMMITTEE ON LYNAS ADVANCED MATERIALS PLANT (LAMP)
The PSC Conclusion

L.A.M.P is a chemical plant; not a nuclear power plant or a mine.

Has fulfilled all the standards and regulation in Malaysia.

Has put in place the necessary control system.
The PSC Conclusion

- Operation licenses issued for Lynas to operate in stages and at certain limit.
- A continuous monitoring committee will be established.
- All 31 recommendations should be implemented.
31 PSC Recommendations

1. LICENSE AND PERMITTING PROCESS

2. COMMUNICATION AND INFORMATION DISSEMINATION

3. STRENGTHENING ENFORCEMENT AGENCIES

4. HEALTH, SAFETY & ENVIRONMENT; RESIDUAL

5. INVESTMENT AND SOCIO-ECONOMY
GENERAL LESSONS LEARNT

High level of awareness of public on HS&E;

Risks are real, need to be understood and can be managed;

Scientific-based facts vs. emotions / perceptions;

The synergy of science and politics – maturity & complementary;
GENERAL LESSONS LEARNT

Community engagement is very important;

Malaysia HS&E standards comparable to the world standard;

Can be a model country where risks can be managed efficiently, reliably and with integrity.
UMP’S ROLES

ASM COMMITTEE ON RARE EARTH

PARLIAMENT SELECT COMMITTEE L.A.M.P

AWARENESS SESSIONS FOR IPT’S STUDENTS
UMP’S ROLES

PROFESSORIAL TALK WITH COMMUNITY

MEDIA ENGAGEMENT

INTELLECTUAL DISCOURSE
UMP’S ROLES
RARE EARTH RESEARCH CENTERS, UMP

RADIOACTIVE AIR MONITORING CENTER
- 2 AMS stations
- AELB
- Karlsruhe Institute Tech

RARE EARTH RESEARCH CENTER
- UMP-LYNAS Chair
- Peking Univ; local universities
- Nuclear Malaysia
RARE EARTH R&D AREAS AT UMP

- Rare Earth Processing
- Rare Earth Process Plant Scale up and Design
- Rare Earth Application in Petrochemical, Manufacturing and Automotive Industry
- Rare Earth Metallurgy and Science
- Safety and Environmental Management on Rare Earth Processes/Plants
- Responsible and Sustainable Mineral Mining and Production
Blueprint for The Establishment of Rare Earth-Based Industries in Malaysia

"A Strategic New Source for Economic Growth"
Main Objective:

to provide the necessary information for the policy makers or investors to make an informed decision on establishing industries in mining, in processing or in downstream industries using rare earths metals.
What Next?

All relevant parties need to work closely and put the national agenda above all interests in investment decision;

Public understanding, awareness and engagement are vital in minimizing conflicts;

Higher education institutions can play significant roles in educating the public research and dissemination of knowledge, without fear or favour.


REFERENCES

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8) ASM Report on Rare Earth Industries : Moving Malaysia’s Green Economy Forward, August 2011.


10) LYNAS Investor Presentation; May 2011.


12) USA Today, 5th August 2007.


14) ProEdgeWire Online, 16th October, 2012.