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Project Management, Renewable Energy & Rural Development

Maria Retnanestri & Hugh Outhred, 16/9/08

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Project management definition for this presentation (http://en.wikipedia.org/wiki/Project_management; 2/5/07)

- Project Management is the discipline of organizing and managing resources in such a way that these resources deliver all the work required to complete a project within defined scope, quality, time and cost constraints.

Planning: Scope Objectives Resources	→	***Implementation:*** Transformation of Resources to Outcomes	→	***Re-invention:*** Reviewing Improving Redirecting

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The challenge

- Growing concerns about climate change, energy security & broader environmental & physical constraints, eg:
  - Flow constraints & high prices for oil, natural gas, coal & uranium
- Energy use facilitates most human activities:
  - Involuntary rationing may lead to social instability
- Rural communities in developing countries lack even basic access to affordable and reliable energy services
  - Frugality, efficient energy use & renewable energy resources are key options to explore
- *Can effective project management techniques assist in meeting the challenge?*

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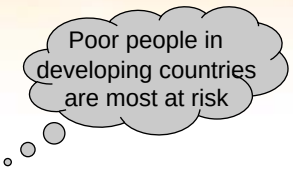
Interrelated threats to global human society

(*Collapse,* Jared Diamond, 2005)

1. Destruction of natural habitats
2. Collapse of wild fish stock
3. Loss of biodiversity
4. Loss of soil quantity & quality
5. Fossil fuel flow constraints
6. Fresh water quantity & quality
7. Photosynthesis limits
8. Toxic chemicals
9. Introduced (alien) species
10. Climate change
11. Population growth
12. Per-capita human impact



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To avoid dangerous climate change: *need to phase out coal by 2030!* (Hansen, 2008)

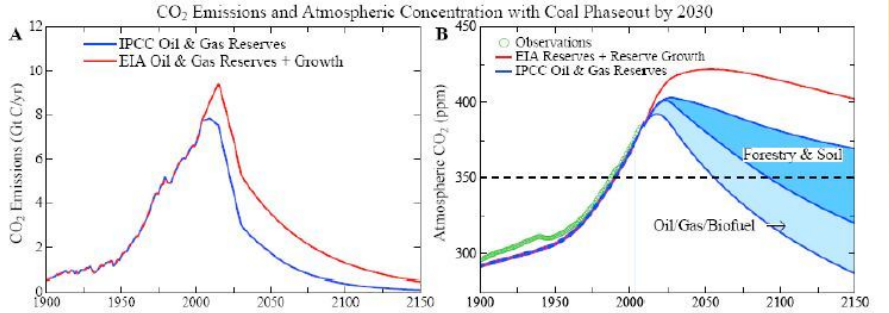

Fig. 6. (A) Fossil fuel CO_2 emissions with coal phase-out by 2030 based on IPCC (2) and EIA (58b) estimated fossil fuel reserves. (B) Resulting atmospheric CO_2 based on use of a dynamic-sink pulse response function representation of the Bern carbon cycle model (57, 58).

http://www.columbia.edu/~jeh1/2008/TargetCO2_20080317.pdf

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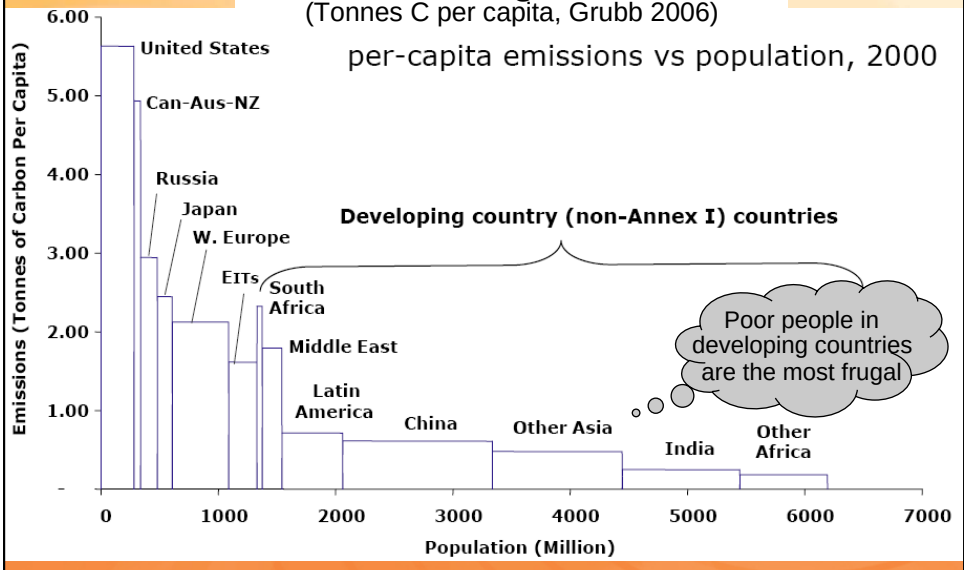
Climate change emissions

(Tonnes C per capita, Grubb 2006)



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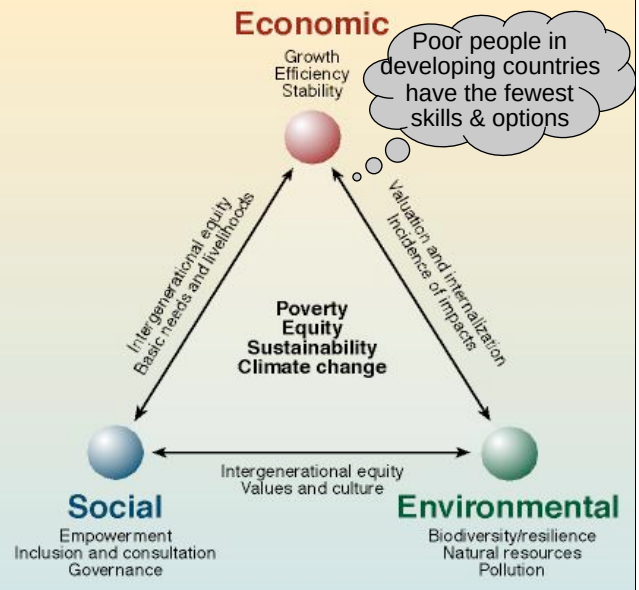
Sustainability context for the electricity industry
(IPCC COP7)

Must also achieve resource adequacy:
Short & long-term system security (availability & quality of supply)

Key elements of sustainable development and interconnections



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The catch (in using renewable energy for remote communities)

- Renewable energy resources and efficient & appropriate energy use offer promise for remote communities:
  - However, they have yet to meet that promise in practice.
- For example in Indonesia, despite the large number of off-grid Photovoltaic Energy Service (PVES) installations to date and the considerable support provided by the government and donors, PVES has yet to prove its sustainability and remains inaccessible to most remote Indonesian communities.
- *Can improved project management techniques facilitate better outcomes?*

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PV energy service delivery in Indonesia

Key figures - 2005

Population: 226 million
- Java Island: 60%
- Avg Density: 1000
- Jakarta: 13k, Papua: 7

Electrification Ratio: 54%

Installed Capacity: 22.5 GW
Coal-fired: 31%,
Combined Cycle: 28%,
Large Hydro: 14%, **Diesel:** 13%,
Gas: 12%, **Geothermal:** 2%

Captive Power: 7.2 GW

Average kWh/capita: 484
(NTT- 61; Jak- 2800**)**

Demand growth: 8%

The problems in extending the Indonesia's power grid:

- Geographic/demographic characteristics of the archipelago
- High cost of transmission, low level of demand

Solutions for remote area electrification:

- Diesel, Mini/Micro-hydro generation
- PVES (SHS , Hybrid system, specific applications)

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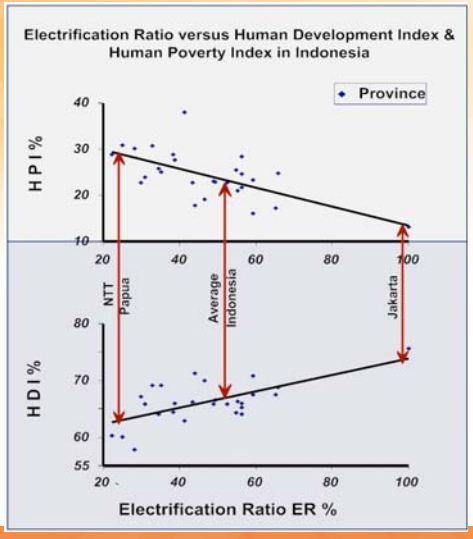
Electrification Ratio & Socioeconomic Development

Trends and Correlation of the Indonesian Provincial ER, HDI and HPI



Indonesian HDI 2005 – 0.728 (107/177)
Australian HDI 2005 – 0.968 (3/177)

HDI components: life expectancy, educational attainment and standard of living

HPI components: poor health, illiteracy, access to clean water and earning below a dollar a day

Access to clean water, health, job, education & communication to facilitate socioeconomic development required

(Sources: BPS 2004, PLN 2004, UNDP 2004, UNDP 2008).

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Off-grid PVES Applications in Indonesia: *Some positive findings*

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Off-grid PVES Applications in Indonesia: *Some positive findings*

PVES in disaster relief: PVES for street lighting, verandah lighting and communication purposes installed at the tsunami refugee barracks, Aceh, Sumatra Island.

Being stand-alone and utility independent, PVES can supply autonomous power for communication, lighting, medical storage, and water purification needs during disaster relief operations.

A 3,600t 10 MW diesel barge, swept 4 km inland, Banda Aceh

A washed away distribution cable.

Photos: Courtesy of Mambruk Enery International, Azet Surya Lestari & Bappenas

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Off-grid PVES Applications in Indonesia: *Some issues*

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Enhancing PVES delivery sustainability & PM Techniques

- Off-grid PVES can only access limited resources (time, funding, expertise, etc)
- Off-grid PVES projects risk failure from various sustainability perspectives (institutional, financial, technical, social, ecological) eg.:
  - Access to finance, skills, institution, network
  - PVES suitability to meet local requirements
- PM techniques are instrumental in to identify & manage resources
- A holistic rather than technocratic approach is required to achieve good outcome of PVES delivery:
  - To augment & enhance pre-existing resources (physical, social, human & natural capitals)
  - To involve local ability to adopt, adapt, apply and “reinvent” PVES to suite local requirements
  - To support the ongoing innovation of PVES by rural community beyond the hardware installation stage

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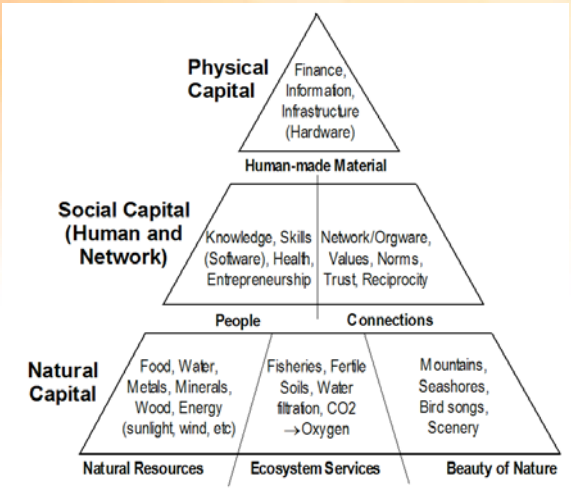
Community Capital/Resources



Reproduced from Hart, 1998, with some modifications.

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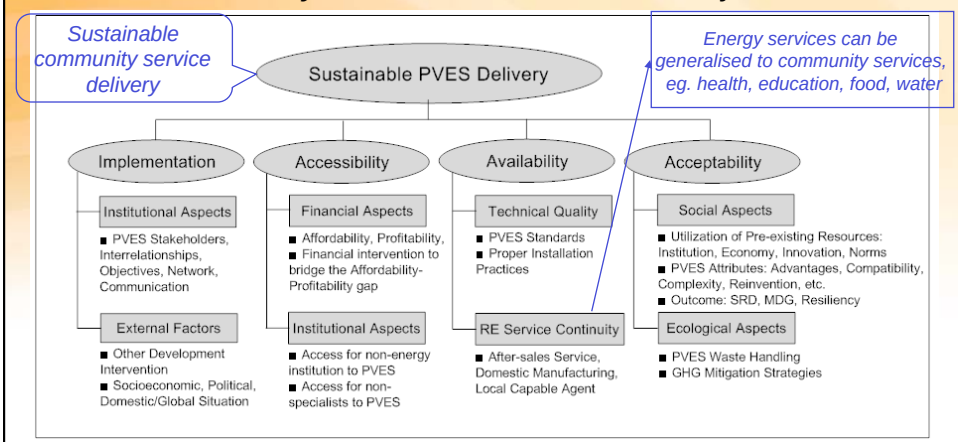
The I3A *Community Service* Sustainable Delivery Framework



To be sustainable it is necessary that off-grid energy services are **implemented**/delivered in a framework that addresses:

Accessibility (financial, technical, and institutional),
Availability (technical quality and continuity of energy service) &
Acceptability (social and ecological goals).

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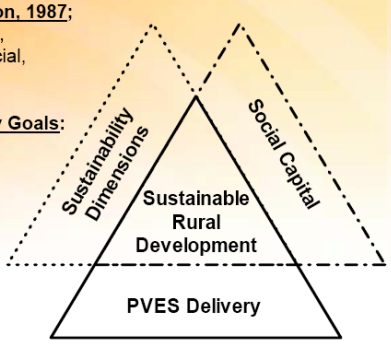
The I3A PVES Sustainable Delivery Framework: *PV in the context of Sustainable Development, Social Capital & Diffusion of Innovation*

Brundtland's SD definition, 1987; SD Dimensions: Technical, Financial, Institutional, Social, Ecological

The WEC's Three Energy Goals: Accessibility, Availability, Acceptability

Objectives (Conceptual Level)



SC is defined as dynamic resources of a community, both structural (organization, union, cooperatives) and cognitive (skill, trust, norms, entrepreneurships), which, subject to its proper utilization, its availability may increase, decrease or remain constant.

Pre-existing Resources & Project Outcomes

Diffusion of Innovation (DOI, Rogers, 1995, 2003):
"The process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p5).

Process and Mechanism (Operational Level)

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The I3A Framework: Assessment & Design Tool for a PVES Project

Sustainable Implementation: Acknowledge all Stakeholders Interests	PVES Accessibility: Minimize Inequity	PVES Availability: Assure Continuity	PVES Acceptability: Utilize & Enhance Community Resources
Process of carrying out PVES project	*Benchmarks / key measures if PVES project builds & sustains PVES Accessibility, Availability, Acceptability*		

Leave community with enhanced capacity and resources for social innovation

To be sustainable it is necessary that off-grid energy services are **implemented** /delivered in a framework that addresses:

- **Implementation:** Guide for project implementation taking into account of PVES stakeholders, their relationships & objectives
- **3A:** PVES sustainability benchmarks
  - **Accessibility:** Financial, Technical, Institutional
  - **Availability**: Technical quality & continuity of energy services
  - **Acceptability**: Social & Ecological goals

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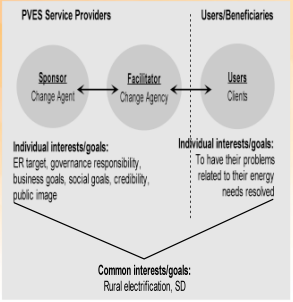
Implementation

PVES stakeholders, interrelationship and objectives



Facilitators Roles:

o Secure PVES adoption by Users in the direction deemed desirable by Sponsor, balancing this with Users requirements

o Create a PVES civic network that acknowledges the interests of all stakeholders, encourages their active participation & promotes their self-reliance

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The 120 kW Public-Private Partnership Micro Hydro (MH) in Cinta Mekar Village, West Java: **Accommodation of local requirements** related to water allocation between irrigation and MH: A written agreement was made to allocate at least 300 litre/second to irrigate approximately 50 hectares of fields prior to water being channelled to the turbine

The PLD (Village Electricity Management) Concept in NTT Province:

o **Active involvement of End Users** (PLD board members were elected among Users, Users define rules of the game & meet routinely) facilitate the creation of a civic network.

o Capacity strengthening (locally adapted standard management training) allows Users to become active participants

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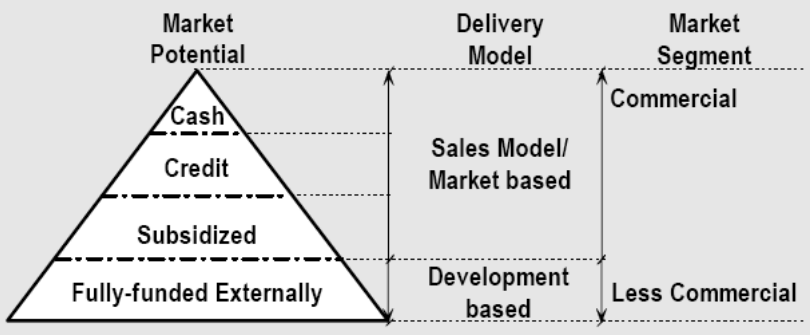
Accessibility

Facilitating Access to PVES Financial, Skills & Network



Delivery Model: *Market Continuum*

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Financial accessibility: Subsidy, second-hand module, flexible payment terms, Combined program (energy service delivery and rural economy empowerment)
→ Facilitators need to understand community's socioeconomic background

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Availability

Maintaining Users Confidence in PVES & Its Providers

Technical quality & continuity of energy service:
oEstablishment of rural outlets
oAgreed rules of technician availability, spare parts price
oLocal capable agent who can make business out of PV service availability (spare parts sales, electronic repair, battery maintenance)
oUsers experience/ innovation

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Acceptability

PVES Acculturation into Local Community's Life

Innovation Attributes & Local adaptation:
Relative Advantage, Compatibility, Complexity, Re-invention (SHS w/o BCR practices, innovation of PVES end uses).

Re-invention: the degree to which an innovation is changed or modified by users in order to solve a wide range of user's problem (Rogers, 1995, 2003).

→ Facilitators need to understand the extent to which PVES can enhance pre-existing resources to support beneficial social innovation

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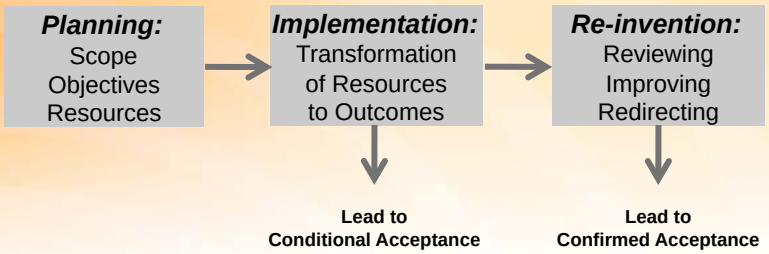
Conclusions: PM Cycle & The I3A Framework



- The I3A Framework: an **Implementation** that maintains PVES **Accessibility, Availability & Acceptability** by looking at:
  - PVES delivery objectives/outcomes to be achieved
  - PVES delivery mechanism (PVES hardware & its stakeholders/orgware)
  - Resources required
  - Ongoing energy service delivery following PVES hardware installation

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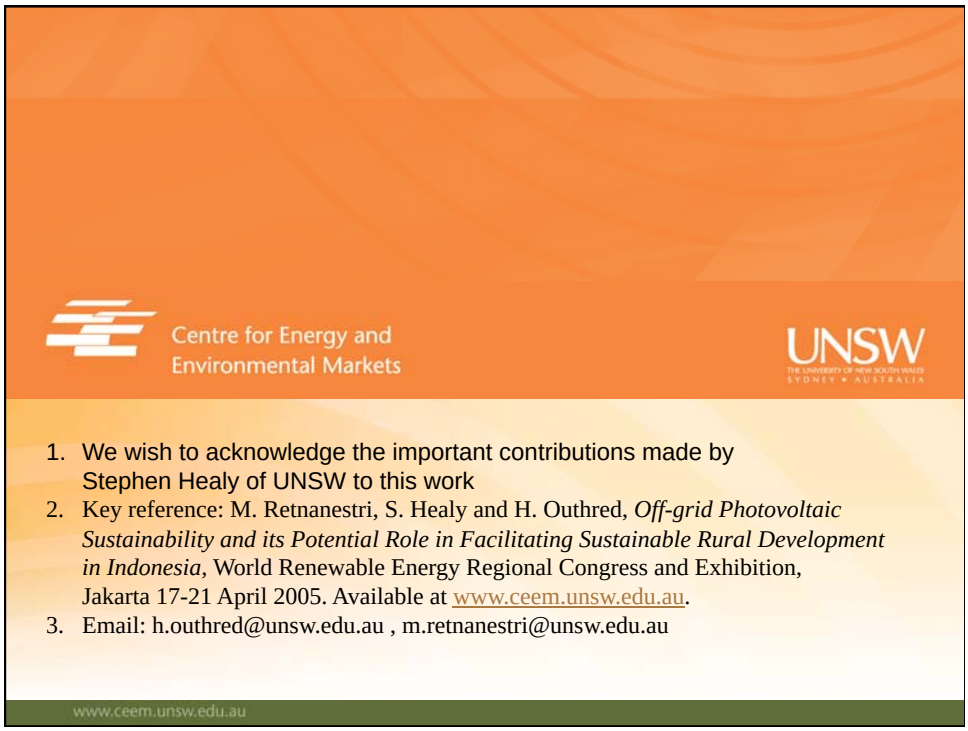
Conclusions

- Energy is a *facilitator* of services:
  - Approach from the perspective of end-use services
- Adopt an inter-disciplinary approach:
  - Science, technology & society
  - Across all related applications, eg energy, water, education, health
- Many countries face similar issues:
  - Poor, rural communities are most at risk
- Correctly applied project management techniques should help to improve outcomes:
  - *But only if PM skills are transferred to rural communities*
- We now have AusAID funding for a 3-year project to further develop these ideas & provide advice on aid project design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THE UNIVERSITY OF NEW SOUTH WALES
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1. We wish to acknowledge the important contributions made by Stephen Healy of UNSW to this work
2. Key reference: M. Retnanestri, S. Healy and H. Outhred, Off-grid Photovoltaic Sustainability and its Potential Role in Facilitating Sustainable Rural Development in Indonesia, World Renewable Energy Regional Congress and Exhibition, Jakarta 17-21 April 2005. Available at www.ceem.unsw.edu.au.
3. Email: h.outhred@unsw.edu.au , m.retnanestri@unsw.edu.au
www.ceem.unsw.edu.au