Enhancing Institutional Capacity for the Market Development of Decentralised Energy Systems in Thailand

Decentralized Energy and CHP Potential
A Possible Energy Solution

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What is Decentralized Energy?

Decentralized Energy is the high efficiency production of electricity (and heating/cooling where possible) near the point of use, irrespective of size or technology.

Fuels -- Gas, Wind, Solar, Biomass, Hydro and or coal.
Centralized generation – pros and cons

### Claimed advantages

- Easier to plan
- Economy of scale
- Low-cost coal = low energy tariff
- Standardisation of equipment

### Flip side

- Capacity addition always trailing demand
- Long gestation period
- High T&D losses
- Poor efficiency and high carbon footprint
- Peak demand is managed only through load shedding
Why Cogeneration/Trigeneration

Energy Cost Savings

Energy costs can be a high proportion of the product cost in many industries. Cogeneration/trigeneration can reduce the energy costs by up to 40%.

Security of Supply

Cogeneration/trigeneration can increase the reliability of power supply. Production processes need to avoid unscheduled shutdown.

Environmental protection

The high overall thermal efficiency of cogeneration/trigeneration minimizes the production of carbon dioxide. Other exhaust emissions can be controlled by the use of low emission combustion technology.

Flexibility of operations

Optimize your operation, dependent on fuel and electricity prices, factory power and heat load.
Cogeneration System

Gas-turbine-based Cogeneration
• Plant size usually based on heat requirement
• Additional fuel burnt at the entry to the WHRU, if required
• Electricity excess exported for extra revenue or shortfall imported
• Exhaust heat can also be used for:
  ➢ Cooling (air-con)
  ➢ Direct drying
  ➢ District heating

Overall Plant Efficiency: up to 77%
Trigeneration System

Overall Plant Efficiency >80%

- Natural Gas
- Gas Turbine
- Heat Recovery Boiler
- Steam 10 Tonnes/hr
- Absorption Chiller
- Electricity for Captive use 3500 kW
- Heat Exchanger
- Chilled Water for Process (15 C)
- Hot water for Process
Environment

- Carbon emissions will increase dramatically - mainly in Asia
- Electricity and heat generation are the main sources of carbon, and increasing

Power generation will be a focused area for reduction/capture to 2020

27 Gtons (2005)

34-42 Gtons (2030)
Thailand: Looking to the Future
Thailand Status Today

- Natural Gas pipeline expanding
- Energy Planning and Policy Office (EPPP) concluded that 3300 MW of CHP potential
- VSSP expanded to 10 MW -
  - Fossil fuel fired CHP gen - have primary energy savings of 10%
  - Net export increased to 10 MW
Challenges to DE/CHP Development

- Gas Pipeline System - Lack of pipeline networks for district cooling
- DE is not included in the planning stages by the Power Development Plan
- No Regulatory Authority to oversee the energy markets
- CHP power sales through open access rules is currently expensive
  - high surcharges, imposition of duplicative transmission charges
Options/Potential

• Improve CHP/DC capacity
  - Create government definition for CHP, track data
  - Perform economy-wide potential study (WADE Study)
  - Create industrial awareness for CHP
• Raise awareness in federal, state and local governments
  - Create special CHP/DC economic zones
• Provide preferential treatment to CHP for arranging inter-state transmission via open access
• Explore the benefits and costs of extending feed-in tariffs for CHP
SOME APPLICATIONS OF DECENTRALIZED ENERGY

• Solar dryers provide women with food security and income. Solar dryers for tea, and plantations

• Solar water pumping and home hot water heaters and electrification to millions of new homes

• Solar energy silk processing and poultry farming in Afghanistan result in farmers earning 20% more

• Diesel/Solar water pumps in villages (grid not reliable)

• Small commercial shops in cities use gen sets (because of load shedding)
Refinery gases where a hydrogen-rich off-gas is produced and used to fire a gas turbine and heat recovery system providing both process steam and electricity. These gases can contain very high levels of hydrogen (>80%).
Gas Turbine Fuels
Landfill gas / Digester gas

Landfill gas
A gas derived by the decomposition of waste in landfill or refuse locations
Comprises predominately methane and carbon dioxide

Issues when burnt in a gas turbine
Contaminants: Some contamination usually present in the form of hydrogen sulfide and siloxanes.
Gas Volume: Lower heating value than std pipeline-gas hence burners need larger passages (no other GT modification required)
Suvarnabhumi International Airport

- JV between EGAT, MEA, and Petroleum Authority of Thailand
- Low pressure steam from 55 MW CCGT - used for chill water
- Total cooling for 563,000 ft²
Commercial complexes

Modern buildings,
100% air-conditioned,
High server loads.
Have high energy requirement
Need very reliable power supply
Of extremely good quality

Combined power + air-conditioning plant, installed inhouse is the best answer.
Complexes coming up in crowded cities. CPP need clean fuel
Policy Messages for DE

- Deep emissions cuts are technically achievable
  - We need an energy revolution
- Cooperation with developing nations is essential
- The task is urgent
  - Capital stock turnover is low
  - Technology deployment needs time to deploy
- Start with existing opportunities
  - Governments should identify and pursue all cost-effective CHP today
Decentralized power generation

10 good reasons

- Fast start-up, ~10 min from hot stand by to full plant load
- Net plant electrical efficiency over 45%
- Combined heat and power as option
- Excellent plant availability and reduced need for back-up capacity thanks to multi-unit installation
- Maintenance schedule independent of number of starts, stops or trips
- Full plant output at high altitudes and hot and dry ambient conditions
- High part-load efficiency
- Minimal water consumption thanks to closed circuit radiator cooling
- Low gas pressure requirement
- Stepwise investment with smaller risks and optimized profit generation
- Full plant output at high altitudes and hot and dry ambient conditions
Summary

- DE is an economic and environmentally friendly approach to power and heat generation and distributes burden of investment cost
  » Short payback periods
  » Reduced carbon footprint
- DE is not restricted to standard fuels but can be applied to alternative/waste fuel sources
- Some considerations are required when using some alternative/waste fuel sources
- Combination of co/trigeneration and the use of alternative/waste fuels makes environmental and economic sense -- Reduces carbon footprint
- Complements centralised generation in many ways
- Provides enormous flexibility
THANK YOU

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