Industrial Energy Efficiency Practices in Indonesia: Lesson Learned from Astra Green Energy (AGen) Award

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Abstract. Many countries have used award system to promote energy efficiency practices in industry. The award system has been found to have significant impact to increase energy conservation and sustainability adoption in companies. Astra International (AI) as a holding company of more than 200 companies also organised Astra green energy (AGen) award to all affiliated companies (AFFCO) in Astra group. The event has been used to share energy efficiency best practices among AFFCO in Astra group. AFFCOs of Astra International are among the biggest and the leader in their industrial sectors Therefore, analyses from AFFO’s energy efficiency case studies represents current practices in Indonesia industrial sectors. Analyses are divided into industry, building, and renewable energy. The results from analyses found that AFFCOs already aware of energy conservation and have implemented projects to promote energy efficiency. However, the AFFCOs do not optimally use monitoring data for energy reduction.

1. Introduction

Many countries have introduced award system to promote energy awareness among industries in its country. Several countries have been successfully implemented award system to promote energy awareness [1]. Indonesia through ministry of energy and mineral resources also creates award system since 2011. The participants of 2016 Penghargaan Efisiensi Energi Nasional Ke-5 (PEEN 2016) have increased 40% from 2015 [2]. The total participants of PEEN 2016 are 84, 6 participants of energy-efficient building, 39 participates in industry and building energy management, and 39 participates in water and energy saving in government building. The increasing number of participants is a sign of energy efficiency awareness growth in Indonesian companies.

Industry sector is responsible for 21% global CO2 emission and 28% energy consumption [3]. To reduce global emission, the Indonesian government set target to reduce carbon emission by 29% in 2030 [4]. Consequently, companies in Indonesia have to reduce their emission to achieve the government the 2030 target. Although award system increase energy awareness but the winner of green company awards does not always positively correlate with stronger company values in the market [5]. Therefore, award system can only be treated as a trigger to start energy project in the companies.
Industrial sector differs than residential sector as energy consumption must be weighed against its productivities. Any investment to reduce carbon emission will increase production cost. Particularly, the government incentive to green industry in Indonesia such as tax incentive is still not clear. Therefore, the motivation behind a company in Indonesia to reduce energy consumption is driven by cost reduction resulted from less energy consumption. Consequently, energy awareness in company must be framed in energy-efficiency context.

PT Astra International (AI) created Astra green energy (AGEn) award to promote energy awareness to all its affiliated companies (AFFCO). The AFFCOs can submit their energy-efficiency project to win an award and learn from other AFFCOs about current energy-efficiency best practices. AFFCOs of PT AI are the leader in industrial sectors in Indonesia. Therefore study of energy-efficiency projects in AGEn award is important to provide information of current implementation stage of energy-efficiency projects in Indonesia companies.

2. Methodology
The research are based on 2016 AGEn award competition. The AFFCOs under PT. AI are invited to submit their energy-efficiency project report. Total of 86 projects have been submitted to be included in AGEn award competition. There were 3 categories competed in the AGEn award including industrial project, green building, and renewable energy. The committee then reviewed project reports and selected finalists among the participants under those 3 categories. The finalist were choose solely based on reports and did not include any field visitation. All the finalists then were invited to present the projects in front of the committee. At the final stage, the committee also visited the companies to review the projects.

Data from project, presentation and visitation reports from all the finalists were summarised and presented in this paper. The data from each category were qualitatively discussed based on the finalist solutions to solve the problems.

3. Astra Green Energy (AGEn) Award Results.
Evaluation on program reports have resulted finalists of 3 categories are presented in tables 1, 2, and 3. Table 1 presents 9 programs in industrial project category. Table 2 showed 3 programs in green building category. Table 3 presents 4 programs in renewable energy category. The number in all tables does not reflect the rank of finalists.

| No | Participant | Industry Sector | Project Name | Solution |
|----|-------------|-----------------|--------------|----------|
| 1  | PT. Astra Daihatsu Motor (ADM). | Manufacturing | Melting furnace replacement | Replacement of old melting furnace with energy efficient melting furnace. |
| 2  | PT. Pama Persada Nusantara distrik Aria. | Mining contractor | Water fill pump remote control | 1. Replacement of water-pump with more efficient water-pump. 2. Utilisation remote control to control water-pump. |
| 3  | PT. Pama Persada Nusantara distrik Kideco. | Mining contractor | Vehicle fuel efficiency | 1. Vehicle management including utilisation |
of GPS tracking.
2. Integrated car pool and vehicle cleaning station.
3. Utilisation RFID for fuel monitoring.
4. Fuel consumption inspection.
5. Eco-driving training.

4  PT. Pama Persada Nusantara distrik Rantau. Mining contractor Smart energy
1. Pick-up station.
2. Power meter installation to monitor electricity consumption.
3. Employee energy conservation awareness socialisation through sticker.
4. Utilisation of timer to automate electricity usage.
5. Lamp replacement with LED.
6. Utilisation of solar panel.

Table 1. Cont.

5  PT. Gaya Motor. Manufacturing Green compressor and automation system
1. Compressor modification.
2. Valve automation.

6  PT PAM Lyonnaise Jaya. Public services Electric energy consumption efficiency in water treatment installation
1. Utilisation inverter to automate valve.
2. Replacement of old water-pump with more efficient water-pump.

7  PT. Toyota Astra Motor Service-Part Division (TAM). Distribution Massive stock reduction
1. Logistic cross dock.
2. Firm order.
| No | Participant                              | Industry Sector | Project Name          | Solution                                                                 |
|----|-----------------------------------------|-----------------|-----------------------|---------------------------------------------------------------------------|
| 1  | PT. Asuransi Astra Buana (AAB).         | Insurance       | Green office          | 1. Lamps replacement with LED lamps. 2. AC timer.                          |
|    |                                         |                 |                       | 3. AC temperature awareness sticker. 4. AC partial replacement.           |
|    |                                         |                 |                       | 5. Curtain to limit heat dissipation from sun.                            |
|    |                                         |                 |                       |                                                                           |
| 2  | Astra Otopart (AOP).                    | Manufacturing   | Head office green     | 1. Redesign cooling tower. 2. Replacement of water-pump.                 |
|    |                                         |                 | energy                |                                                                           |
|    |                                         |                 |                       |                                                                           |
| 8  | PT. Toyota Motor Manufacturing Indonesia (TMIN). | Manufacturing | Energy conservation and efficiency on boiler system | 1. Energy saving visualisation board. 2. Boiler system energy reduction through heat and water condensation recovery. |
| 9  | PT. Yutaka Manufacturing Indonesia Plant Division. | Manufacturing | Cooling system electricity energy efficiency | 1. Redesign cooling tower. 2. Replacement of water-pump.                 |
Isuzu Sales office. Sales and distribution

Sales office energy control and monitoring in 52 branches.

1. Energy awareness poster.
2. Whatsapp group for consolidation.
3. Lamps replacement with LED lamps.

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Table 3. Renewable energy finalists

| No | Participant | Industry Sector | Project Name | Solution |
|----|-------------|-----------------|--------------|----------|
| 1  | PT. Pama Persada Nusantara distrik MTBU | Mining contractor | Solar energy for mobile and fix tower installation. | Solar panel installation on mobile and fix tower installation. |
| 2  | PT. Astra Honda Motor (AHM). | Manufacturing | Solar energy for production support. | Solar panel installation in AHM Krawang Plant. Grid tie system. |
| 3  | PT. Toyota Motor Manufacturing Indonesia (TMIN). | Manufacturing | The utilization of wind energy from cooling tower fan into electric energy by implementation of wind turbine. | Wind implementation on cooling tower fan. |
| 4  | PT. Yutaka Manufacturing Indonesia | Manufacturing | Hybrid wind mill & solar cell. | Combination of wind turbine and solar cell for street lamp |

4. Discussion

Table 1 summarised 9 best projects in industry. Among the finalists, 4 companies are from manufacturing, 3 from mining contractors, 1 from distribution, and 1 from public services. Manufacturing process that consumed energy to create heat makes the projects from manufacturing companies are focus on reducing energy consumption for heating process or cooling system to reduce excessive heat. Therefore, the solution is replacing the old equipment with more efficient machine. However, PT TMMIN project is one step ahead of other companies, the company utilised heat and water condensed from boiler to conserve energy. To monitor energy consumption the companies also installed power meter to monitor machine energy consumption. Although the power meter is able to provide data in minutely basis and ready to be integrated into IT system, but the monitoring still performed manually and use human to take a note of the energy consumption.

In mining industry as most activities requires operation of vehicle and equipment that consume fuel. The energy saving is focus on fuel efficiency. The solution is a combination of energy policy, business process of engineering, and utilisation of monitoring equipment such as RFID and GPS tracking. The energy policies are addressed by providing energy awareness through poster and sticker. Reengineering process to make vehicle route shorter through creation of pick-up station and integrated of car pool and washing facility. One interesting solution is utilisation of remote control to for easy control of water pump in order to prevent 24-hours operation of water pump. Utilisation of power meter to monitor energy consumption also has been implemented.
PT PAM Lyonnaise Jaya utilise inverter to automate valve for a more efficient water distribution and replacement of water pump. PT TAM as a distribution company reengineers distribution process to reduce stock in warehouse. As the stock number reduce the related energy consumption needed such as light, ac, etc. also decrease.

Green building finalists share similar solution. Lighting, air condition (AC), and building occupants behaviour are the main focus of reduction. Replacement of conventional lamp with LED and utilization of timer to control AC usage is typical solution in building. Poster and sticker are selected to increase awareness of building occupants. Utilisation of group chat application helps company to monitor and coordinate among branches as practised by PT. ISO.

Renewable energy finalists focus on utilisation of wind turbine and solar panel to power equipment or building. PT Pama Persada as mining contractor utilise solar panel to power mobile and fix communication tower. PT AHM develop wind farm on rooftop of the manufacturing building to provide energy for manufacturing process. The energy from wind farm is tie-grid with electrical system. Although PT Yutaka only use renewable energy to power street lamp, but hybrid wind turbine and solar panel to create stable supply for light is interesting. The solution from PT. TMIN is unique, instead of relying on natural wind energy, the wind turbine utilise cooling tower fan to conserve energy.

5. Conclusion
PT AI is one of largest and leading holding companies in Indonesia. Many of AFFCOs of PT AI are the leader in industrial sectors. Therefore, energy efficiency practices in the AFFCOs reflect current best practices of energy conservation in Indonesia. Study from finalist of AGen award projects and participants show the companies in Indonesia already aware about energy conservation and have implemented projects to reduce energy consumption.

Energy-efficiency projects from industry are varied and depend on the industrial background. Several companies can conserve the energy through business process engineering, while others choose to replace old equipment or machine with more efficient equipment/machine. Simple solution such as utilisation of water-pump remote control is found to be cheap and effective. Some companies also already use IT system such as GPS and RFID to monitor vehicle position and fuel consumption. Although some companies already use power meter to monitor energy consumption, but the utilisation is not optimal. While other finalists are still focus on reducing energy consumption, PT TMMIN has been one step ahead by harvesting wasted energy to conserve energy.

Energy-efficiency projects in building are still limited in lighting replacement and AC scheduling. The occupants behaviour as the important factor in building is only reminded by sticker and poster that is not effective. Renewable energy projects are focus on wind and solar energy harvesting. Solution from PT TMMIN to harvest energy from installing wind turbine on cooling tower is reduces the dependency to natural wind.

Although the AFFCOs has implemented energy-efficiency, but the AFFCOs still do not utilise real time monitoring data. The data collected are still in low aggregate although the equipment can provide high aggregate real time data from monitoring equipment such as GPS, RFID, and KWh/Power meter can be collected and mined to find the pattern such as occupants behaviour in building or fuel consumption pattern. The pattern can provide more insight to of energy consumption in company.

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