Advanced Energy Technology Recommendations

APO Workshop in Jakarta Recommends Advanced Energy Technologies for Adoption by Countries in the Asia-Pacific (1–5 June 2015)

Background

Seventeen energy professionals from 12 Asian Productivity Organization (APO) members convened for a workshop jointly organized by the APO and Directorate of Productivity, Government of Indonesia, 1–5 June 2015 in Jakarta. After intensive deliberations, study of thematic papers presented by each country over five days, and review of expert presentations and similar initiatives, the workshop recommended the following advanced energy technologies/practices for the Asia-Pacific region.

ADVANCED ENERGY TECHNOLOGIES

1. Adoption of Variable-frequency Drive (VFD) instead of Throttling

Numerous industries control the flow and pressure of air from fans and blowers or water flow from pumps by throttling, resulting in substantial energy losses. Using VFDs would save energy and costs.

2. Energy-Efficient Motor (IE-Class-3 and above)

At present, many of the electric motors in use in industries are inefficient. The life cycle cost of motors is less than 5% compared with the electricity consumed over a life cycle of 10 or more years. It should therefore be made mandatory for all Asia-Pacific countries to use only energy-efficient IE-3-certified motors and ban the manufacture and sale of inefficient (non-IE-certified) motors.

3. Top Gas Recycling Blast Furnace (TGRBF)

TGRBF technology recycles up to 90% of top outlet blast furnace gas (BFG), mixes it with pure oxygen, and blows it back into the blast furnace. It can increase the efficiency of iron smelting since it requires less coke and coal, reduces heat loss from off-gas, and reutilizes the CO in BFG. The BFG will contain little nitrogen, be more valuable, and together with oxycombustion, will make it easy to utilize carbon capture and storage (CCS). (A pilot plant has already succeeded,

although due to economic difficulties, the demo plant project scheduled for 2015 has been postponed.)

4. Solid oxide fuel cells (SOFCs)

SOFCs use solid oxide as electrolytic material. The electrolytes allow oxygen ions to pass from the air to fuel and generate electricity. Since no nitrogen passes through, the flue gas may be simply CO2 and H2O. If combined with a gas turbine or diesel engine using oxyfuel combustion, it can increase power generation efficiency by more than 70%. At the same time, the flue gas will be almost pure CO2, which enables easy CCS. This technology can also be combined with coal or biomass gasification. (Currently, the price for SOFCs is still very high, but is expected to drop sharply within 5 years.)

5. Light-emitting Diode (LED)

Lighting consumes high levels of electricity in every town and city in all countries. Those lights are sometimes left on even during daytime hours, wasting electricity. LED lights consume much less energy than conventional lamps. The changeover of all existing lighting to LED lights would allow industries and governments to save significant amounts of energy and tax revenues.

6. Energy-efficient Pumps for Demand-side Management

As most Asian countries have a large agricultural base, millions of agricultural pumps are in operation. In most countries, electricity provided to farmers is subsidized, and they often use inexpensive, inefficient pumps. Because many pumps are rewound several times, their efficiency decreases even further. The use of energy-efficient pumps would reduce electricity consumption by agricultural pumps markedly through demand-side management. The expected new energy consumption level would be cut to almost half of current levels.

7. Oxyfuel Combustion

Using pure oxygen mixed with recirculated CO2 for combustion makes CCS easier. At the same time, since the amount of flue gas is reduced to about one-quarter, efficiency can be increased to compensate for the penalty of the air separation unit. Without nitrogen in oxidants, NOx levels are reduced. Some steel

companies are considering the adoption of this technology in their reheating furnaces. (There are 2 boiler demo projects for this technology, one 50-MW boiler in the UK, and another 30-MW boiler in Germany.)

8. Direct Conversion of Renewable Energy to Chemical or Liquid/Gas Fuel

The Gobi Gas project in Sweden is on its way to success. In Italy, plants are making plastics directly from biomass. After gasification, biogas can be converted into chemicals or liquid/gas fuel through several proven technologies. Supplemental or unbalanced renewable electricity can be used to generate hydrogen through electrolysis with SOEC or other technologies. Syngas can be reformed utilizing the resulting hydrogen and CO2, and then after the application of Fischer-Trope or other technologies, chemical or liquid/gas fuel can be obtained.

9. Extensive Data Collection and Analysis of Energy Consumption Using the Internet and Cloud Computing

ICT, especially the Internet and cloud computing, makes it practical and affordable to collect time series records of power consumption from numerous sites. Subsequent big data analysis can identify categorized patterns specific to business characteristics and suggest the best options to reduce total energy costs.

10. Amorphous Iron Core Usage in Electric Motors and Transformers

Energy loss caused by mismatches between load demand and power inputs can accumulate into huge amounts. This type of loss is mostly generated by the joule heat in a metallic core, which can be efficiently reduced by using amorphous iron. Particularly for industrial applications where the load demand changes greatly with variations in the daily production volume, this technology has the potential to improve total energy intensity.

11. Hybrid Trains for Transportation of Goods

Long-distance transportation has become a major challenge for developing countries. Trains are the most cost-effective means of mass transportation but the low rate of electrification of railways leading to carbon emissions by diesel engines and associated low energy efficiency is a key issue to overcome. Hybrid

technology enabling battery recharges via regenerative braking and engines powered by electric motors would be effective in improving the energy efficiency of railway transport.