LEAP Modeling of Energy Consumption and CO2 Mitigation Potential of Turkish Iron and Steel Industry

Seyithan Ahmet Ates
Management Faculty, University of THK/Turkey
*Corresponding Author: sates@thk.edu.tr

ABSTRACT

Energy management is considered as a crucial way to increase energy efficiency, reduce greenhouse gas (GHG) emissions and decrease energy costs. With assistance of techniques, processes and activities which promote more efficient energy use, energy management results in lower costs, carbon emissions and risks, while simultaneously guaranteeing more efficient energy consumption. International Energy Agency report stated that Turkey has one of the most energy intensive industries among the OECD countries, which requires to be lowered. Turkish economy is more energy intensive (0.35 toe) compared to an OECD average of 0.20 toe. A considerable part of energy consumption is met by imported oil and gas (which results in a huge budget deficit in the Turkish economy) indicate the Turkish industry must urgently improve its energy efficiency and introduce systematic ways of energy conversion, such as Energy Management Standards.

Given the need to reduce energy intensity and the CO2 emissions in Turkish Industry, it is crucial for stakeholders and policy makers to know, what is the economic potential of energy management activities and how can these methods contribute to lower GHG emissions.

In this study, with the help of an Energy Modeling Software, The Long-Range Energy Alternatives Planning System (LEAP), we have analyzed economic potential for energy efficiency and CO2 emission reduction in case of EM application. This study relies on four scenario analysis with an aim to investigate the effects of different degree of energy efficiency activities on energy intensity and CO2 emissions in the industry. By introducing more than one scenario, we were able to compare alternative development pathways. The four scenarios, applied in this study are: Business-as-usual Scenario (BAU), Accelerated Energy Efficiency Improvement Scenario (AEI), Cleaner Production and Technology Scenario (CPT) and Slow-Speed Energy Efficiency Improvement Scenario (SEI). These scenarios are based on “what-if” questions, for instance, what-if best available technologies (BAT) are put into practice. Application of benchmarking in the field of energy modeling has increased recently since it is considered a substantial tool for evaluating energy performance and energy efficiency activities by comparing with other entities.

In this study, scenarios are considered as basis roadmaps for establishing appropriate mechanism and plans for future energy management activities. By including BAT and best practicing technologies into the scenario analysis, we seek to highlight the correlation between the energy management practices and the implementations of technical best practices. Respected scenarios estimate the reduced energy compared to BAU projection of energy consumption in iron and steel industry in Turkey from 2010 to 2030.

When considering energy consumption, energy management application and energy intensity figures, some key sectors are particularly concerned in Turkey. However, the scope of this scenario analysis does not allow us to identify more than one industrial branch since each industry has unique parameters and should be evaluated accordingly. As the one of the most energy consuming sector in Turkey, iron and steel sector consume 19.7% of total energy utilized by industry.

To sum up, main objectives of the LEAP scenario analysis are as follows;

- Developing and applying 4 scenarios and future estimations of energy efficiency and CO2 reduction potentials through to 2030 by using energy modeling software, LEAP.

- Identify the current energy management performance of Turkish energy intensive industries
- Estimate the economic potential for energy management activities in case of BAU, AEI, CPT and SEI
- Estimate CO2 emission reduction potential in case of BAU, AEI, CPT and SEI

It is expected that this study will fill knowledge gaps pertaining to energy efficiency potential in Turkish energy intensive industries and help stakeholders in energy intensive industries to realize potentials for the huge energy efficiency GHG mitigation.

Parallel to energy consumption, GHG emissions are also assumed to rise significantly. Through structural adjustment, energy management standard ISO 50001 and governmental supports, varying degrees of energy efficiency improvement can be achieved. With the assistance of the LEAP modeling, we have found that the energy intensity rate can be lowered by 13%, 38% and 51% percent through introducing anticipated mechanism of the scenarios, SEI, AEI and CBT, accordingly. Particularly the projected aggregated energy savings of the scenarios CPT and AES are very promising with the saving rates of 33.7% and 23% accordingly. The contribution of the improvement in the energy efficiency is not limited to economical savings. For the iron and steel industry, declining in energy intensity corresponds also strengthening competitiveness in the international market and sinking GHG emissions. The saving potential of CPT scenario, 33.7%, highlight the fact that proposed tools for increasing management capacity of energy, such as ISO 50001 and setting up an energy management center in the mills, are of crucial priority in terms of implementing structural measures and achieving permanent energy efficiency.

Compared to baseline scenarios, energy efficiency improvements correspond to economic potential of 0.1 billion dollars for SEI, 1.25 dollar for AEI and 1.8 billion dollar for CBT scenarios. Concerning GHG emissions, in 2030 the iron and steel industry in Turkey is estimated to produce 34.9 MtCO2 in BAU, 32.5 MtCO2 in SEI, 24.6 MtCO2 in AEI and 14.5 MtCO2 in CPT scenarios which corresponds to savings of 9 to 39 percent. However, in the case of CPT, thanks to the wide range of anticipated technologies and energy efficiency improvement by corporate energy management, CO2 emission figure is projected to decrease by 25.6% to 14.5 MtCO2 in 2030. The experiences gained from various energy efficiency projects illustrate that not sustainable, one-time projects don‘t bring the desired outcomes after a period of time, if they are not monitored and adjusted in a continuous manner183. Taking into account this fact and the potential of energy management mentioned before, it is considered as the crucial challenge for Turkey in the eye of post Kyoto Protocol process, to facilitate energy management improvements in energy intensive industries, particularly in iron and steel industries by introducing structural and legal adjustments and financial incentives.

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