Alert Energy & Environment (January 2016)

1. **The energy saving activities at JFE Steel Corporation West Japan Works (Fukuyama)**. H. Yamagishi, M. Uno. Read more
2. **Optimised waste gas recirculation layouts for environment-friendly and energy efficient sintering of iron ores**. B. Vanderheyden, F. van Loo, C. Mathy, J.-C. Pierret. Read more
3. **Energy saving CO2 absorption process (ESCAP)**. D. Hagiu. Read more
4. **Improvement of energy efficiency at Tata Steel in Ijmuiden**. R. Hekkens, T. Rozendaal, G. Jägers, J. Bakker, H. Kiesewetter, P. Pronk. Read more
5. **High emissivity coating for energy saving in industrial furnaces: case study of steel reheating furnace.** Songsak Klamklang, Niwat Athiwattananont, Nattapon Jumpit and Navee Angsuputiphant. Read more
6. **Prospects for sustainability certification of metals**. S. Young, Y. Zhe, G. Dias. Read more
7. **Holistic life cycle approach for lightweight automotive components**. F. Karakoyun, D. Kiritsis, K. Martinsen. Read more
8. **Investigation on new steel grades for construction of wind energy mills for sustainable energy supply**. G. Golisch, S. Münstermann, W. Bleck, S. Ufer, U. Reisgen, P. Langenberg. Read more
9. **Towards time-resolved LCA of electric vehicles in Germany**. B. Zimmermann, H. Dura, M. Weil. Read more
10. **Integrated environmental assessment of future energy scenarios based on economic equilibrium models**. E. Igos, B. Rugani, S. Rege, E. Benetto, L. Drouet, D. Zachary, T. Haas. Read more

---

METEC & 2nd ESTAD, June 2015

The energy saving activities at JFE Steel Corporation West Japan Works (Fukuyama). H. Yamagishi, M. Uno

We have implemented energy saving activities since 1973 at Fukuyama Works. Energy-saving efficiency is at about 45% at present, whereas in 1973 it was considered 100% effective. This paper is a report on the organization, the policies, and main methods of our latest energy saving activity.

Optimised waste gas recirculation layouts for environment-friendly and energy efficient sintering of iron ores. B. Vanderheyden, F. van Loo, C. Mathy, J.-C. Pierret

The optimal waste gas recirculation layout for a given sinter plant may depend on local objectives and constraints (e.g. raw materials used, plant configuration and available space, sinter production and quality constraints, energy costs, more pressure on one specific pollutant…). CRM has recently upgraded its sinter model and sintering pilot station at the request of its affiliated steel companies in order to help them in the choice and optimization of waste gas recirculation layouts. The new model version has been validated and calibrated by sinter pot trials and on site measurements at different sinter plants. It has then been used to assess the impact of a wide range of waste gas recirculation layouts on productivity, energy consumption and emissions (CO, CO2, NOx and SOx). Finally it was used for supporting two ArcelorMittal plants in the selection, pre-engineering and economical evaluation of envisaged investments.

Energy saving CO2 absorption process (ESCAP). D. Hagiu

ESCAP (Energy Saving CO2 Absorption Process) has been developed as the most efficient energy cut-off chemical absorption process for carbon dioxide capture in the project sponsored by NEDO (New Energy and Industrial Technology Development Organization) in Japan. In order to develop a high performance process, CAT30 (the testing plant of 30 tons-CO2/day) was placed near the blast furnace in Kimitsu Works of

NSSMC (Nippon Steel & Sumitomo Metal Corporation) to take in actual blast furnace gas into the test plant and had been operated for about totally 8,000 hours in three years. Achievements of RN absorbent, which had been developed by NSSMC and RITE (Research Institute of Innovative Technology for the Earth), were 43% reduction in reaction energy (2.3 GJ/t-CO2) and 30% increase in CO2 absorption respectively relative to MEA. In addition to the above, process performance of energy consumption was hardly declined during the 2,000 hours continuous running test, though heat stable salts were slightly observed without reclaiming absorbent. RN absorbent has the tendency to liberate CO2 so much easily in a stripper that it is easily possible to lower regeneration temperature in a stripper keeping energy consumption in the CO2 absorption process low. Through the tests at CAT30 of lowering the regeneration temperature from 110 deg-C to 80 deg-C, it was confirmed that 95 deg-C was the lowest temperature to keep the recovery rate 90% and the energy consumption 2.3 GJ/t-CO2. This fact enables to utilize such low quality energy as steam below 110 deg-C, and to widen utilization of waste energies still not be utilized.

Improvement of energy efficiency at Tata Steel in Ijmuiden. R. Hekkens, T. Rozendaal, G. Jägers, J. Bakker, H. Kiesewetter, P. Pronk

The steel industry has made significant advances in energy efficiency over previous decades. Tata Steel in IJmuiden is in the top quartile worldwide for energy and CO2 performance and the overall energy balance has improved significantly in last years. In recent years, since 2010, the major changes in energy efficiency were:

- The overall specific energy consumption (WSA scope) decreased by 8% whereas the overall direct specific CO2 emission also reduced by 6%.
- The natural gas consumption decreased by 9% through increased use of process gases and reduction of natural gas demand.
- Electricity consumption reduced by 3%.
- The net electricity export increased through optimised use of electricity generation capacity from process gases, decreased consumption and higher efficiencies.
- Losses of high quality energy carriers that decreased: flaring of process gases reduced, blow-off of steam reduced, venting of oxygen reduced.
- Losses of low quality energy carriers (waste heat) reduced.

Continuous reduction of energy use and costs (part of total conversion costs) is required for a sustainable business. To achieve the abovementioned energy savings a rigorous process was required. A large-scale energy efficiency programme was started in 2011 at Tata Steel IJmuiden and it will end in 2015. After finalisation of the programme, an energy management system according to ISO 50.001 will be put in place to drive continuous improvement. Part of this energy management system will be the delivery of an energy KPI system for the whole site, which helps in monitoring energy use and signals the need for preventive action. With these processes in place, Tata Steel IJmuiden intends to stay at benchmark level with regard to energy efficiency.

SEAISI Quarterly Journal March 2015

High emissivity coating for energy saving in industrial furnaces: case study of steel reheating furnace. Songsak Klamklang, Niwat Athiwattananont, Nattapon Jumpit and Navee Angsuputiphant.

More than 90% of energy liberated in steel reheating furnaces is transferred by radiation. Considering the scale and the importance of the steel reheating furnaces, an improvement of radiation heat transfer can lead to remarkable increase in the production yields or decrease in the fuel gas consumption. The high emissivity coating was developed to maximize thermal efficiency of reheating furnaces by improving radiation absorptivity and emissivity of inner walls that affected on reduction of radiation in band of gas, while increased amount of additional radiation passes directly to billet inside the furnace. The high emissivity coating material was successfully applied in steel reheating furnace that presented the appreciate reduction of fuel gas

consumption. The application of high emissivity coating resulted on decrease of fuel gas consumption up to 6.5%.

Metallurgical Research & Technology, July 2014

Prospects for sustainability certification of metals. S. Young, Y. Zhe, G. Dias

Certification initiatives are product-focused, rely on standards and use sustainability metrics to inform end-users on the provenance of commodities. In the metals sector, the phenomenon of formal certification programs has recently gained traction. Four initiatives are reviewed to illustrate the status and prospects of metal certification. The prime case is the Conflict Free Smelter Program operated by the global electronics industry. This scheme has developed and applied standards on mineral chain-of-custody, including use of third-parties to audit smelters and refineries all over the world. Additional programs discussed are the Green Lead Project, Fair Trade and Fair Mined gold, and the Responsible Jewellery Council. Collectively these initiatives address a variety of sustainability criteria, including social, economic and environmental dimensions, but focus only on precious and specialty metals (Au, platinum group, Pb, Sn, Ta and W). Metals certifications programs are building capacity and infrastructure compared to mature programs in agriculture and other commodity sectors. Opportunities and issues for growth of metals certification are considered.

Holistic life cycle approach for lightweight automotive components. F. Karakoyun, D. Kiritsis, K. Martinsen

Since sustainability and environmental issues rose lately, lightweighting has been the point of interest for automotive and aerospace sectors. Lightweighting reduces the fuel consumption of the vehicles and as a result of this reduces emissions. Aluminum, especially wrought aluminum alloys, have large potentials for dramatic weight reduction of structural parts while maintaining the safety and performance. Wrought aluminum alloys are used in automotive skin, bumpers and suspension parts etc. Lightweight suspension parts improve the ride quality and handling, additional to fuel consumption and emission reduction. Holistic life cycle approach takes into account the material flows and related information flows in order to achieve these material flows through the life cycle of the components as well as performance characteristics not only in technical and economic terms but also environmental and social terms. It is necessary to have seamless information flow through the life cycle of the components that could be enabled by the closed-loop product life cycle management (PLM). Closed-loop PLM may also help collection of life cycle information which is necessary to generate performance characteristics and distribution of performance characteristics among life cycle actors

---

Investigation on new steel grades for construction of wind energy mills for sustainable energy supply. G. Golisch, S. Münstermann, W. Bleck, S. Ufer, U. Reisgen, P. Langenberg

In regard to the sustainability of future cities, an increase in sustainable energy sources needs to be managed. Therefore, the German government decided on increasing the ratio of green energy up to 20% by 2020. In accordance with this, offshore wind energy parks will be constructed, as they provide the advantage of lasting air cleanliness and preserving natural resources. To ensure construction safety, wind energy mills are constructed using ductile steels of large thickness. Here, an application of high-strength steels provides the possibility of reducing the amount of material while construction safety is still ensured. Considering the long life cycle of wind energy mills' foundation structures and the recyclability of the steel grades used, their construction becomes a relevant factor in reducing CO2 emissions. Furthermore, the use of less material reduces CO2 emissions. Due to existing safety concepts, however, the application of high-strength steels is only conditionally allowed. Thus, the current study concerns the development of a safety concept based on the existing concepts to allow the application of high-strength steels. Furthermore, as the structural steel parts need to be

joined, an energy-efficient welding process is utilised: electron beam welding. The structural steel parts and weld joints are investigated with respect to their mechanical properties by analysing their loadability in combination with safety concepts. The load on the material is evaluated to ensure construction safety. In addition to the investigation of safety requirements, the supplied mechanical properties are investigated. As the weld joints show different properties from the base material, the joints are considered the critical part. The joints are investigated concerning strength and toughness. Afterwards the mechanical properties are correlated with the wind energy structures. The prevention of failure is fulfilled when the mechanical properties of the weld joints exceed the required mechanical properties.

Towards time-resolved LCA of electric vehicles in Germany. B. Zimmermann, H. Dura, M. Weil

Electric vehicles in Germany are expected to have an average lifetime of twelve years. During their long use-phase these vehicles rely on electricity from the power grid. A historic review shows that over the last twelve years the German electricity-mix has undergone a massive transition. Renewable energy sources are on the rise, while nuclear power is phased out. This trend is expected to continue. Since the environmental impacts of electric vehicles depend on the electricity-mix, this study performs a life cycle assessment that respects the transitions in the observed time-span. This study defines the new term "time-resolved LCA", in contrast to conventional LCA- and dynamic LCA-methodology, as an LCA-approach which is based on statistical, time-resolved data. Time-resolved LCA aims at becoming a simple and feasible method to reduce model-uncertainty in LCA. The authors conclude that time-resolved LCA improves model-quality significantly. Most environmental impacts of electric vehicles decrease, when the more precise time-resolved approach is employed. Further implications of the new approach are outlined.

Integrated environmental assessment of future energy scenarios based on economic equilibrium models. E. Igos, B. Rugani, S. Rege, E. Benetto, L. Drouet, D. Zachary, T. Haas

This paper aims at presenting the modeling system and preliminary results of a research project conducted on the scale of Luxembourg to assess the environmental impact of future energy scenarios for the country, integrating outputs from partial and computable general equilibrium models within hybrid Life Cycle Assessment (LCA) frameworks. The general equilibrium model for Luxembourg, LUXGEM, is used to evaluate the economic impacts of policy decisions and other economic shocks over the time horizon 2006−2030. A techno-economic (partial equilibrium) model for Luxembourg, ETEM, is used instead to compute operation levels of various technologies to meet the demand for energy services at the least cost along the same timeline. The future energy demand and supply are made consistent by coupling ETEM with LUXGEM so as to have the same macro-economic variables and energy shares driving both models.
