Case Studies

Standards for Affordable and Clean Energy

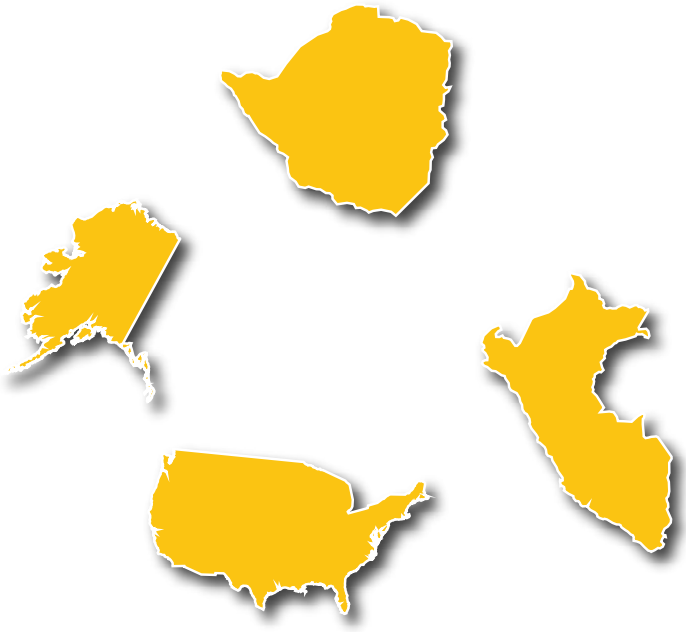
Case study n°1

Applying ASTM International Standards in Support of Environmentally Friendly Fuels

Countries: Peru, United States of America, Zimbabwe

Level: National, Subnational and Local

SDG Addressed: SDG7 – Affordable and Clean Energy



Summary

The objective of this case study is to demonstrate how ASTM standards, regarding alternative and renewable fuels such as ethanol and biodiesel for road vehicle use, are used in Peru, the United States and Zimbabwe to reduce the use of fossil fuels. Standards were critical in evaluating the safety of alternatives, promoting commercial success and encouraging regulator and public acceptance. Their adoption by the regulator resulted in an increase in the use of local forms of energy and helped reduce energy imports. The government agencies involved were national regulatory and standardization authorities. This directly contributed to the achievelent of SDG Goal 7.2 "increase substantially the share of renewable energy in the global energy mix."

Background

Regulatory and market momentum continue to build for alternative and renewable fuels, such as ethanol and biodiesel for road vehicle use. Both support the use of local forms of energy and help reduce energy imports. For example, ethanol is widely used as a gasoline extender and octane number enhancer; biodiesel is an alternative fuel derived from vegetable oils and animal fats. Standards are critical to evaluate the safety of alternatives, promote commercial success and encourage regulation and public acceptance.

Strategy

The five standards work together to reduce the use of petroleum-based fuels:

- D4806 for Denatured Fuel Ethanol for Blending with Gasoline for Use as Automotive Spark Ignition Engine Fuel;
- D5798 for Ethanol Fuel Blend for Flexible-Fuel Automotive Spark-Ignition Engines;
- D6751 for Biodiesel Fuel Blend Stock for Middle Distillate Fuels;
- D975 for Diesel Fuel Oils;
- D7467 for Diesel Fuel Oil Biodiesel Blend.

Results and Impact

According to the U.S. Environmental Protection Agency, "greenhouse gas emissions from the transportation sector primarily involve fossil fuels burned for road, rail, air, and marine transportation." Ethanol fuel produces less greenhouse gas emissions than gasoline or diesel. "Biodiesel… usually produces less air pollutants than petroleum-based diesel."

Energy use policy citing alternative fuels must be backed by technical specifications to facilitate acceptance in the public and private sectors. These technical standards are critical to the activities carried

out by those regulating, selling, purchasing, operating with, and testing the fuel.

Challenges and Lessons Learned

The challenges included:

- Modifying the requirements of long-standing fuel compositions calls for broad stakeholder engagement (regulators, producers, equipment manufacturers of end-use products).
- The range of laboratory equipment needed to adequately confirm the achieved specifications may not be available in all countries due to varying levels of economic development.
- Taking a balanced approach, when prescribing fuel composition that is represents performance-based property limits and remains flexible enough to accommodate geographical, seasonal and regulatory requirements.

Standards represent an effective, time tested tool for transferring innovative knowledge pertaining to fuel additives and alternatives to practical application. For Zimbabwe, the denatured ethanol standard D4806 was adopted to use for checking the quality of ethanol being used for mandatory blending. The denatured ethanol standard is referenced in the Statutory Instrument 17 of 2013. Zimbabwe produces biofuels mainly for energy security, reduction of fuel import bill and environmental protection. The country is currently facing acute foreign exchange shortages and use of biofuels assists in reducing the fuel import bill.

For the United States of America, the commitment to a strong, sustainable agricultural and industrial economy includes usage of both traditional petroleum based fuels and biofuels. In order to ensure that fuels conveyed for consumption are produced in conformance with strongly developed, consensus driven specifications. The Tennessee law, for example, directs the adoption of ASTM International standards for engine fuels which has resulted in a remarkable improvement in the uniformity of fuels supplied in the state, with 97 % compliance on all fuels analysed.

For Peru, the ASTM standard D4814 helped the government to establish new specifications of motor use gasolines to address national requirements for lower levels of lead and sulphur. Peru also referred to the ASTM International standard D6751 in the Supreme Decree DS 021-2007-EM, Regulation for Biofuels Commercialization, because a suitable national standard did not exist. When the Peruvian Technical Standard NTP 321.125:2008 was eventually developed and approved, it was based on ASTM D6751, with modifications for conditions that are specific to Peru.

Potential for Replication

The ASTM standards are feedstock neutral enabling the universal application of the specifications. Diesel fuel is used globally for a wide range of automotive and heavy equipment diesel engines. Recognizing the impact of fossil fuels on climate change, regulators, manufacturers and consumers are inclined to consider, accept and support options that lessen the environmental impact of petroleum fuels. ASTM International voluntary consensus standards make such changes possible.

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Case study n°2

Requirements for technical acceptance of wind and solar projects for energy auctions in Brazil

Country: Brazil

Level: National

SDG Addressed: SDG7 – Affordable and Clean Energy

Summary

The objective of this case study is to demonstrate how standards – in particular, those based on IEC international standards - were used to improve the system of energy auctions. The implementation of the revised standards-based instructions must be followed by auction participants. This allowed a substantial increase in the number of compliant projects submitted and a better management of submission, analysis and approvals by the Energy Planning Authority of Brazil. This directly supports the achievement of Goal 7b "expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all".

Background

Electricity auctions for the regulated market in Brazil are held 3 to 6 years before the energy delivery. This anticipation, associated with long-term Power Purchase Agreements, ensures the bankability of projects. On the other hand, the uncertainty associated with the construction of new power plants, requires a qualification stage, in order to guarantee that candidate projects accomplish the necessary requirements. For this qualification, the Energy Planning Authority of Brazil set the requirements, aiming an offer of feasible projects, contributing to increase the share of renewables in energy matrix.

Strategy

Instructions for project developers were published addressing technical requirements that must be followed for acceptance of projects for energy auctions. The requirements are frequently revised due to technological evolution, aiming the critical points for the success of new power plants. Eventually, the developers are consulted to improve the instructions. For example, there is no clear definition for power capacity of photovoltaics inverters, as it depends on the local temperature (for solar panels, for instance, international standards sets the conditions to measure its parameters). Due to the lack of proper standards for inverters, the Energy Planning Authority made a public consultation and, with the technical contributions received, set a consensus. Regarding the on-site measurements (solar and wind resource), the instructions also specify the requirements such as maximum distance from measurement station to project site, campaign duration, necessary instruments, quality of sensors and minimum height, considering the international standards (e.g. IEC 61400, ISO/IEC 17025 and ISO/IEC Guide 98-3). The standardized parameters help the developers when installing the stations and allow for the comparison of measured data.

Results and Impact

The standardization of requirements for qualifying wind and solar projects result in an increasing

number of accepted projects and contracted power plants. Some of the impacts achieved include:

- Since 2009, the percentage of approved projects was between 55 percent and 65 percent, demonstrating the importance of technical qualification.
- In 2017, auction registered more than 900 wind projects and 600 photvoltaic projects, representing more than 46 GW in proposals from renewable sources.
- This process resulted in the contraction of more than 500 (12 GW) wind and 140 (3.8 GW) PV power plants in last years.
- More than 600 wind measurement stations and more than 100 solar radiation stations fulfilled the requirements, reducing uncertainty in available primary resource and energy production estimation. This also contributed to improving the knowledge on the available resources in the territory.
- The qualification process is valid for energy auctions on the regulated market, but nowadays, even free market uses it: some independent companies ask the developer for the technical approval by the Energy Planning Authority before buying energy from new projects.
- Banks also require Energy Planning Authority´s technical approval when financing new projects, aiming more confidence on its feasibility.

Challenges and Lessons Learned

The main purpose of these requirements is to avoid future problems with new power plants, which could expose electricity consumers to risks. When writing the requirements, the Energy Planning Authority tries to identify the potential risks, aiming to enhance security in energy supply. At the same time, it is important to keep in mind that strict requirements can lead to more expensive projects. For example, wind measurements must be carried out for at least 3 years, using high-quality instruments, which takes time and investment. Complicated rules can also reduce a number of candidate projects, reducing the competition for lower energy prices.

Since 2007, many improvements have been introduced to its instructions, of the Energy Planning Authority considering the lessons learned during the period. The main lessons learned include:

- Some projects from different developers were discovered in the same place that would result in problems if both sell in the auction. Thus, some additional requirements were introduced regarding the right of using the land.
- With development of wind energy, some projects were very close to each other, especially in regions with good wind, what would result in turbulence and wake effects, reducing the energy production. To face this problem, a geodatabase was developed to analyse "shadowing" between wind farms and determined that energy production reports should consider the effect of all neighbour projects, even those from other developers, despite its phase (planned, in construction or operating).
- Due to a big number of candidate projects, a system of managements of submission, analysis and approval was developed. This web-based system is accessed by developers, who fill in the project datasheet, and analysts from the Energy Planning Authority, who check the registered projects and ask for documents and extra data without personal identification.

Potential for Replication

Among the available mechanisms to buy energy, auctions have been considered by many countries, as it encourgaes competition for lower energy prices and can be used with existing and new power plants. The Energy Planning Authority published a series of Instructions to be followed by project developers in auctions. The similar process and requirements can be used in others countries that wish to buy energy through the auctions.

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Case study n°3

Energy Reform in México - Upstream Regulation that promotes the Sustainable Development of the Oil and Gas Resources

Country: Mexico

Level: National

SDG Addressed: SDG7 – Affordable and Clean Energy

Summary

The objective of the case study is to show how the United Nations Framework Classification for Resources (UNFC) is being used by the National Hydrocarbons Commission of Mexico in order to sustainably develop natural gas deposits, so as to ensure that the national energy policy is well aligned with the SDGs. Additionally, this will improve the consistency and coherence in the capture of social and economic value, including tangible and intangible aspects of diverse resources; allow for a better integration of conventional and unconventional resource management and enhanced planning for the strategic development of the resources at different goverment levels and faster adoption of new technologies and business models. This will support the achievement of SDG 7b "expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all".

Background

The Energy Reform initiated in Mexico (2013) has the primary objective of developing a more affordable clean source of energy. In Mexico, the main sources of this type of energy are located in unconventional deposits that need to be developed sustainably. The Energy Reform has the further objective of strengthening energy regulation and ensuring the correct regulations of oil and gas activities - including the technical evaluation of the country's economic resources.

Strategy

The United Nations Framework Classification for Resources (UNFC) provides an analytical framework for studies on energy, mineral and renewable energy resources, which considers the analysis of government policies, the classification and management of resources, the planning of processes and the allocation of capital in an efficient manner.

Additionally, the UNFC represents a standardized system that helps linking and analyzing the Sustainable Development Goals, that will serve as a basis for the definition of an effective platform to make decisions in energy policy and regulatory actions and will facilitate the interaction with other government institutions and stakeholders.

Results and Impact

The adoption of the UNFC linked with the Sustainable Development Goals will be specially relevant for the government institutions responsible for managing energy resources (Energy Ministry, Regulatory bodies, National Oil Companies) and this adoption will be important to achieve:

- Support the general direction of energy policy to be in alignment to the Sustainable Development Goals;

- Support the fine tuning of the regulatory aspects to be constructive and well aligned to the energy policy;
- Consistency and coherence in the capture of social and economic value, including tangible and intangible aspects of diverse resources;
- Integration of conventional and unconventional resource management;
- Planning for strategic development of the resources at different goverment levels;
- Faster adoption of new technologies and business models.

Additionally, the consistent use of specifications of the United Nations Framework Classification of Resources will allow the easy collection and assimilation of information for: (i) External reports (for example: stakeholder communications, sustainability reporting etc.); (ii) Financing (for example: stock exchange reporting;investment raising from the banks etc.) (iii) Statistics and maintenance of national inventories.

Challenges and Lessons Learned

The identification of the lessons learned is currently in the process; the pilot test related to this case study is undergoing. Such an exercise in applying an international standard, which is related to Sustainable Development Goals at a national level, has not been performed elsewhere in the region. While there are no other significant examples to follow, this exercise sets an example of its own.

Potential for Replication

The experience of this case study and the pilot test (focusing mainly in the development of the natural gas resources- conventional and unconventional), could be extended to the renewables projects in Mexico (both solar and wind). Moreover, the experience gained in Mexico could be replicated in other countries in the Latin American region and, possibly, other regions like Africa within the framework of south-south cooperation.

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Case study n°4

Implementation of the Energy Management System (EnMS) in accordance to the UNIDO Methodology and ISO 50001 at large industry companies

Country: The former Yugoslav Republic of Macedonia

Level: National

SDG Addressed: SDG7 – Affordable and Clean Energy

Summary

The objective of this case study is to demonstrate the benefits of proper implementation of an energy management system for industry, by training representatives of the energy teams of several companies in essential implementation of the energy standards in accordance to ISO 50001.

This training contributes to the building of national capacities by boosting the awareness of industries that require energy efficiency improvements through structured approaches with clear defined standards. By adhering to already defined international standards the companies have a guarantee that the service received is of sufficient quality and it ensures accurate performance indicatiors for their processes. This will support the achievement of SDG 7.3 "By 2030, double the global rate of improvement in energy efficiency."

Background

The Macedonian industrial sector is an energy intensive sector, taking more than 40% of the energy consumption in the country. None of the established policy measures in the country have addressed energy consumption of the industrial sector, especially the large companies.

With implementation of the ISO 50001 Energy Management System certification standard in the country, there is a framework for establishing energy management best practice to help the industry to improve their energy efficiency and make a return on investment. The standard enables organisations to establish the systems and processes necessary to improve energy performance, including energy efficiency, use, and consumption. Subsequntly, this helps to bridge the gap that was present by the lack of policy measures.

Strategy

ISO 50001 is based on the management system model of continual improvement also used for other well-known standards such as ISO 9001 or ISO 14001. This makes it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management.

ISO 50001 provides a framework of requirements for organizations to develop a policy for more efficient use of energy an data to better understand and make decisions about energy use and measure the results.

Results and Impact

The results of trainings have increased the national capacities and the implementation of ISO 50001 Energy Management System in the industry in the former Yugoslav Republic of Macedonia has resulted in:

- 12 Partner enterprises (70% success rate);

- 23 Natational Consultants / Expert Trainees;
- Full cost/value of National Consultants;
- Include progressive development and implementation;
- Energy Savings 1 Yr: 13.19 GWh (67% no cost);
- Energy Savings 5 Yr: 165 GWh;
- Money savings 1 Yr: 862,700 USD (55% no cost);
- Money savings 5 Yr: 10,792,000 USD;
- Cost of the pilot project so far: 290,000 USD.

Challenges and Lessons Learned

The biggest challenge was to inform companies that proper monitoring tools provide a practical and affordable way of reducing energy consumption, in addition to optimizing the production and efficiency of their processes.

Developing the pilot project for the implementation of ISO 50001 with established companies, has demonstrated how the application of international standards strengthens trust between companies and improves the quality of services. Accordingly, when an international standard provides clear guidance for implementation, measurable indicatiors of performance and a proper benchmark for comparison between companies, then the conversation is rederected from “does this work?” to “how to make this work for my company?”.

Potential for Replication

This pilot project was used as a starting point in developing the energy management system in the industry. The main objective is for this to be replicated across the entire industrial sector. This kind of projects are easily replicated in developing countries with similar industrial sectors.

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Case study n°5

The Use of Alternative Energy Resources in the Carpathian Region of Ukraine

Country: Ukraine

Level: National

SDG Addressed: SDG7 – Affordable and Clean Energy

Summary

The objective of the case study is to show how international standards on Energy Efficiency have been used by the State Commission of Ukraine on Mineral Resources to conduct a preliminary analysis to promote the development of alternative, non-conventional, energy sources including thermal waters in the region of Carpathia. This directly contributes to the achievement of SDG 7.2 "By 2030, increase substantially the share of renewable energy in the global energy mix".

Background

The implementation and application of alternative (non-conventional) energy sources is a government priority for the Carpathian region. The legislation favors the use of alternative energy sources in the fuel-energy complex, which is legislated in: the Law of Ukraine On Alternative Energy Sources, the Program of Governmental Support of Development of Non-Conventional and Renewable Energy Sources and Small Hydro- and Thermal Power.

Alternative energy sources in this region include wind, solar radiation, biomass, soil heat (including hydrogeothermal energy), rivers. An advantage of the use of alternative energy sources is the low carbon emissions. The most favourable conditions for the use of thermal waters can be found within the flat part of the Transcarpathian region. The use of thermal waters is economically feasible for Berehove, Kosyno, Zaluzhzhia, Terebliany deposit. The potential of water power resources has been assessed in the Zakarpattia Region. An advantage of the use of geothermal power stations is their ecological compatibility. Discharge waters are re-injected into the underground horizons that provide the region with eco-safety and a stable ecological cycle.

Development of non-conventional energy is one of the factors which guarantee national and ecological security in Ukraine. The use of alternative energy sources will: reduce dependence on the import of expensive energy carriers, provide energy independence for remote consumers of electric power, stimulate the development of production connected with microelectronics, electrical engineering, hydromechanics, special construction.

Strategy

The national standards in energy efficiency, renewable energy and alternative fuels have been harmonized with the ISO standards (e.g ISO 50001:2014, DSTU ISO 50004:2016, DSTU ISO 50015:2016).

Results and Impact

To develop alternative energy resources it is necessary take the following steps:

- perform zoning of the territory according to prospects and efficiency of the use of one or another type of energy and to develop the

information-analytical system for operational control and management of energy equipment;

- apply state-of-the-art wind- and solar accumulating power plants for power supply of individual consumers (decrease in energy dependence can promote reduction of prices for tourist services) and a possibility of feeding power networks;

- equip small hydroelectric power stations on the mountain rivers;

- equip hydrothermal spas and to consider a possibility of heating the houses with geothermal installation.

The conduct of additional studies on the use of water power resources in the Carpathian region is required for production of eco-friendly electric power.

Challenges and Lessons Learned

The use of geothermal resources is complicated compared to the conventional energy sources. The cost of geothermal stations with the total capacity of 2.0 – 2.5 ths of MW fluctuates between 1.5 and 2.0 billion USD. The payback period for such a project is estimated at less than 5 years. Accordingly, the use of geothermal energy represents a challenge on account of: (i) considerable costs for drilling of wells and re-injection of wasted water and (ii) creation of corrosion resistant heat technology.

Potential for Replication

This experience can be used other countries, especially those that are rich in thermal waters (for example Hungary).

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Case study n°6

Integration of large scale photovoltaic power plants as a largest solar power plant world wide in Benban – Aswan Governorate – South of Egypt

Country: Egypt

Level: National

SDG Addressed: SDG7 – Affordable and Clean Energy

Summary

The main objective of this case study is to show how generating green electricity can be utilized in achieving the national social and economical development. The international standards, mainly IEC standards, are introduced in the Solar Energy Plants Grid Connection Code and the Egyptian Transmission Grid Code. This directly contributes to the achievement of SDG 7.2 "By 2030, increase substantially the share of renewable energy in the global energy mix."

Background

The current situation is that only 50 MW are connected to the grid since March 2018, and the remaining capacity will be operated in two stages and be completed by mid of 2019. After starting its full operation, the impact according to variable generation from this large power plant , the four substations may be disconnected separately or together, and that will cause a big problem to the grid operator (Dispatch centre), that there will be a need to a standby generation from conventional power plant or from Hydro power plant from Aswan High Dam.

Strategy

Solar Energy Plants Grid Connection Code in addition to the Egyptian Transmission Grid Code and The Egyptian Distribution Network are mainly based on IEC standards. Some examples of the used IEC standards include: IEC 62446, IEC 62305-3 , IEC 62271 , IEC 62116.

Results and Impact

The international standards will support the Egyptian Grid in the following ways:

- Grid connection requirements, such as grid connection point, solar plant component, grid connection ranges, start-up of the solar plant, power quality (harmonics, flickers, voltage unbalance, voltage fluctuations), and grid protection.
- Power Operational and maintenance requirements, such as active power control, reactive power control, fault ride through maintenance.
- General administrative connection process, such as application for connection point, solar plant development application, connection agreement; initial tests, clearance for connection, commissioning test and certificate.
- Testing and commissioning.

Challenges and Lessons Learned

The operation of the largest solar power plant will introduce certain challenges for the grid through its impact, such as fluctuations, evacuation of the electricity generated,etc. The main challenge is enhancing capability of the grid operator (Engineers and Technicians) to be able to deal with the large solar power plant, to synchronize this plant with the grid and understand all the grid code problems, mainly the power quality problems. After finalizing the construction and start of operation of this large power plant, all capacity will be connected to one point, so there will be many case studies and more availbale data.

Potential for Replication

IEC Standards have a high degree of replicability and the usage of the standards in this case study can be considered in other locations in Egypt or worldwide.

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