

INNOVATIVE OSH SOLUTIONS AT ȚĂGIGHIOLŌWIND FARM CONSTRUCTION SITE OF ȚĂLEA NUCARILORȚTULCEA COUNTY

1. Organisations involved

- S.C. BV ULIA SRL (sub-entrepreneur of S.C. Energomontaj S.A., Romania)
- Enel Green Power Romania (part of Enel Group)
- Gamesa Energy Romania SRL (local division of Gamesa Spain)
- S.C. GES Green Energy Specialists SRL (sub-entrepreneur of Gamesa Energy Romania SRL)

2. Description of the case

2.1. Introduction

This case study focuses on a series of innovative OSH solutions that were implemented during the construction of ȚĂgighiolŌWind Farm.

Enel Green Power Romania operates in the area of renewable energy sources and is the beneficiary of the construction works carried out within ȚĂlea NucarilorŌconstruction site.

Wind power is the most promising regenerative technology in Romania, with a predicted output of approximately 3600 MW by 2015.

The ȚĂgighiolŌWind Farm, which consists of 17 wind turbines, represents the beginning of the generating capacity of Enel Green Power in Romania. The overall installed capacity of the park is 34 MW, which is enough to satisfy the power needs of over 35,000 homes in the region. According to Enel, this avoids a yearly emission of 70,000 tons of carbon dioxide and will provide a considerable positive impact upon the neighbouring environment and the health of the regionŌs population.

Given the incontestable benefits of the renewable energy sources and the Ōclear environmental advantages when compared to conventional sources of energyŌe.g. reduced environmental impact, no contamination and/or accumulation of radioactive wastes, no water courses alteration, increased control during exploitation, etc., this type of construction project is expected to be carried out in various regions of the country.

The complexity of the construction works necessitated a multidisciplined workforce and a number of different subcontractors to provide the required capabilities e.g. specific construction techniques and equipment, properly trained workforce and expertise.

Fig. 1 ȚĂgighiolŌWind Farm from ȚĂlea NucarilorŌIndustrial Park of Tulcea County, Romania. View of the wind turbines



These companies addressed the different technical requirements of the various types of the construction works through innovative technical solutions. Concomitantly, these technical solutions demanded an innovative safety approach in order to properly address the hazards in terms of workers' safety and health, such as fall from height, slips, trips, etc.

This case study particularly refers to three innovative OSH solutions used for work at height, insulation works and maintenance operations related to various components of the Agighiol Wind Farm. The measures were implemented by three distinct Romanian construction companies under a single OSH co-ordination that facilitated a joint approach to safety.

The challenges that this case study intends to highlight consists of aspects relating to risk management. These challenges were overcome under a single safety co-ordination for the entire construction site, which was managed by an OSH co-ordination expert from the beginning of the construction works in 2009.

This resulted in safer workplaces through the reduction/elimination of risks and a highly skilled and OSH trained workforce.

The three construction companies this case study refers to are:

- S.C. Bv Ulia SRL, a local Romanian company from Tulcea and sub-entrepreneur of S.C. Energomontaj S.A., Romania, that used special scaffolding to carry out the thermal insulation of the power station building roof, along with other civil construction works
- Gamesa Energy Romania SRL (the local division of Gamesa Spain) that introduced two special types of PPE for use by workers when climbing inside the wind turbine to carry out finishing operations at the rotor blades
- S.C. GES Green Energy Specialists SRL (sub-entrepreneur of Gamesa Energy Romania SRL,) in charge of complex maintenance operations of the aeolian stations

2.2. Aims

The innovative OSH solutions applied by these companies at the construction works of the Agighiol Wind Farm were principally aimed at the elimination/mitigation of the various risks to the workers' safety and health, regardless which companies they worked for.

The improvement of workers' training aimed to ensure the workforce was well trained and capable of safely accomplishing the work tasks required.

Concomitantly, the technical measures were meant to ensure the quality of the construction works so that they complied with the standards imposed by the beneficiary i.e. Enel Green Power Romania.

A coherent and successful approach to OSH related measures was one of the major objectives envisaged, despite the complexity of the operations to be accomplished and the significant number of subcontractors involved in the achievement of the construction works.

2.3. What was done, and how?

This innovative OSH approach was put in place at the Agighiol Wind Farm construction site by three distinct Romanian construction companies. OSH solutions were implemented to safely accomplish a series of complex operations such as: 1) the thermal insulation of a large surface of the power station's concrete roof; 2) finishing operations of the rotor blades at the wind turbines; 3) a wide range of maintenance operations at the aeolian stations.

Particular attention was paid to workers' training, both in terms of acquiring adequate skills to carry out complex work tasks and with regards to safe behaviour in achieving these tasks.

The OSH training was adapted to each type of operation to be performed, to the workers' level of knowledge/awareness about the related risks and to their normal working attitude and aptitude to observe safety rules. A single OSH co-ordination existed, which was managed by the OSH co-ordinator of the construction site.

1. **S.C. Bv Ulia SRL** was assigned the task of thermally insulating the roof of the power station building.

Fig. 2a and 2b: The power station building under construction

Fig. 2a



Fig. 2b



The following main aspects have been concomitantly considered:

- Technical aspects

- The technical problem related to the insulation works consisted of the large surface of the power station's concrete roof to be insulated (width 4.5 m x length 14 m) through a multi-layer thermal insulation.
- The technological procedure used for the insulation works consisted of a special scaffolding support, based on classical scaffold elements with adjustable props.
- This scaffolding support allowed adequate adjustment of the working height through its adjustable props and thus safe working postures for the workers, despite the varying height of the roof.
- This technical solution has contributed to reducing/eliminating the risk of a fall from height, which is the most frequent major accident associated with scaffold working and in most cases results in fatalities.
- Adequate technical and OSH training of the workers
 - Adequate training was provided to the workers so that: i) they acquire improved knowledge and skills in order to accomplish their specific work tasks (eg. to erect/dismantle the scaffolding, to adjust it at the proper working height, to carry out the insulation works properly, etc.); and ii) they adopt safe working postures and a safe behaviour, in general.
 - Worker teams' training has been periodically carried out in the presence of the supervisors and the OSH co-ordinator. This training was carried out monthly, in accordance with the legal provisions, as well as weekly or prior to the achievement of each type of operation.
 - Appropriate instructions and practical applications for the special PPE used for working at height were significant elements of the OSH training, given the complexity of this type of equipment e.g. harnesses, safety belts, helmets, etc.

2. Gamesa Energy Romania SRL, the local division of Gamesa Spain, adapted personal protective equipment (PPE) for the workers in charge of special finishing tasks at the wind turbines. The two main operations addressed were: i) climbing inside the tower of the wind turbines to access the rotor blades for finishing operations; and ii) carrying out a series of remedies on the surface of the wind turbine's rotor blades. The adapted PPE were meant to ensure workers' safety against a fall from height and/or slipping when carrying out these operations, which presented a significant risk to their safety and health.

- i. The access to the wind turbine rotor blades is made via the turbine tower i.e. through an open sided lift (without cabin), which slides on a flexible steel support inside the wind tower. The worker who ascends the inside of the tower sits in a so-called 'hammock' chair that provides safe access to the turbine rotor blades, thus avoiding/reducing the risk of a fall from height (the overall tower height is 100m while the turbine rotor is placed at 70m above the ground level).
- ii. The second type of PPE consists of a complex safety harness equipped with a fall arrester system (recovery trolley). It was adapted to be compatible with operations, to repair damage to the surface of rotor blades which may occur during transport and erection. This harness is specially designed to protect workers when carrying out repair operations on the rotor blades' surface at a height of 70 m outside the wind tower. In addition, these repairs might be necessary at any point on the blades' surface, which measures 50m in length. The special design of this type of PPE makes it possible to carry out these operations safely and provides protection against a fall and/or slip from the rotor blades.

The worker teams in charge of this type of operation were given **customised OSH training** to provide them with appropriate knowledge and skills for using these special types of PPE properly and

to raise their awareness on the risks they are exposed to, especially falls from height and slipping. Training was provided on a weekly basis in addition to the monthly training sessions prescribed by the law.

Given the complexity of the PPE and the number of wind turbines (17) several workers were trained for this particular kind of interventions. Consequently, they could continually improve their skills and adopt a safe behaviour in their day-to-day work.

3. S.C. GES Green Energy Specialists SRL (sub-entrepreneur of Gamesa Energy Romania SRL, the local division of Gamesa Spain) is in charge with the maintenance operations of the aeolian stations.

- The maintenance operations are very diverse given the complexity of the aeolian stations. They involve surveillance, repairs and maintenance works.
- Consequently, the OSH training of maintenance personnel had to be adapted to all these types of maintenance operations to eliminate/reduce the risks arising from a large variety of work tasks.
- Therefore, the OSH training for the workers in charge of these maintenance operations was appropriately adapted, both in terms of scheduling (frequency of the training sessions was dependent upon the specific needs of the workers and the types of tasks to be undertaken)) and topics i.e. for each type of operation to be carried out.

OSH co-ordination as part of a successful risk management approach

The major challenge was to ensure successful risk management through a single OSH co-ordination, taking into account the large variety of operations to be carried out and the different companies (subcontractors) engaged in the construction site works.

- Enel Green Power Romania (part of Enel Group) provided a single OSH co-ordination for all the construction companies working within Agighiol Wind Farm, including the three companies this case study deals with.

This OSH co-ordinated approach consisted of the following:

- A prevention plan was drawn up on the basis of a rigorous risk assessment made for each workplace and the work activity.
- The customised OSH training addressed:
 - the general and specific risks identified at the workplace level,
 - the various training needs of the workers depending on their specific work activities,
 - the significant variations in: workers' professional background and qualifications, their perception of risks, the adaptability to the workplace safety requirements, and the capability to acquire the necessary knowledge and skills to cope with the work tasks and the OSH requirements in their day-to-day work,
 - the particularities of the PPE to be used by the workers depending on risks associated with the workplace/work tasks.
- OSH training was provided on a monthly basis as prescribed by law but also on a weekly basis depending on the specific work tasks planned, or whenever deemed necessary.
- The OSH training included interactive sessions with debates on positive/negative examples from the construction site, short films and/or videos, comments on workplace photos showing good/bad working situations, etc. The workers could express their opinions on the materials presented and the particular working situations they had to cope with. The training sessions were also attended by

the workplace supervisors and the management representatives.

- Positive examples were promoted within the construction site and the working teams with the best results and fewest incidents were rewarded accordingly (an increase in their monthly income, etc.).

The OSH co-ordinator and/or the OSH representatives carried out random on the spot visits to the workplaces and regular inspections to check that preventive measures were correctly implemented and observed by the employees.

2.4. What was achieved?

- Zero work accidents have been registered since the beginning of the construction works at Agighiol Aeolian Park in August 2009. So, there are over two consecutive years with zero work accidents during the undertaking of high risk activities such as foundation works, scaffolding erection, work at height, achievement of the main concrete structures.
- The workers' knowledge and skills have been considerably improved as a result of the tailor made OSH training. In addition, through the regular monitoring of workers (on the spot inspections made by the OSH representatives) a safer working behaviour has been noticed regarding the use of adequate PPE, safer postures at work, and the awareness of work at height related risks..
- A change in workers' attitude towards the OSH rules/measures at the workplace. Workers now appreciate the benefits to their own safety and health rather than viewing them as something they are obliged to do and/or fearing penalties.
- Safer workplaces have been created through the use of new construction techniques and work equipment.
- These innovative/improved OSH measures have also contributed to the stabilization of the workforce in the region, particularly on the Aeolian Park which is valuable,, given the prolonged duration of the works.. Workforce fluctuations are likely to increase costs and result in an increased risk of work accidents for the newly employed and less skilled workers, as well as being detrimental to the quality of the works.
- An appropriate OSH co-ordination resulting in well trained workers and the elimination of work accidents. It also had a positive influence on the quality of construction resulted in lower costs.

2.5. Success factors

An important success factor was the use of innovative construction techniques and equipment to increase workplace safety and comply with the requirements of special construction operations such as insulating large surfaces, building wind turbines that are over 100m in height, carrying out complex maintenance operations, etc..

The three companies invested both in innovative working technologies and the improvement of OSH knowledge and skills.

Workers' OSH training was adapted according to the nature of the construction operations and the complex PPE to be used, both in terms of training topics and periodicity e.g. weekly training sessions in addition to the monthly training provided by the law. This contributed to a large extent to a well trained workforce capable of safely undertaking complex work tasks.

The expertise of an external OSH co-ordinator from a research and development institute contributed to the quality of training. An external OSH consultancy was also provided to identify the best prevention solutions to achieve positive results (zero work accidents during the undertaking of complex construction works).

The commitment of the company's leadership to provide professional and OSH training for the workers and the provision of adequate monitoring of the prevention measures to ensure they were

implemented successfully.

2.6. Further information

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2.7. Transferability

There are prospects for the construction of further wind farms in Romania in the future. Important foreign/domestic investors in collaboration with Romanian companies intend to begin/extend such renewable energy projects in Romania.

Similar construction works have begun to build a 70 MW installed capacity wind farm, with 35 wind turbines and a 189 million kWh yearly output. This will ensure the annual power needs of 70,000 homes and avoids the release of 106,000 tons of carbon dioxide into the atmosphere.

A new vision for the future of wind energy in Romania was presented at the Romanian Wind Energy Forum 2011, in light of the EWEA (European Wind Energy Association) estimations that by 2020, wind power could satisfy 15.7% of EU power consumptionȐ

This vision for green power development in Romania will result in similar construction works, requiring similar technical solutions and OSH training. So, there is an excellent transferability potential for the technical and OSH solutions employed at ȐValea NucarilorȐ Wind Farm.

In addition, a well-trained and skilled workforce would be an asset in view of the high transferability potential to similar construction sites in the region. Traditionally construction work accounts for a high proportion of workplace accidents and there is a need to implement measures, similar to those described in this case study, to coordinate OSH amongst subcontractors and to minimise the risks associated working at height.

The stabilization of a well trained workforce and a reduction the high rate of unemployment and migration of a skilled workforce, would be beneficial to all organisations/regions and further contributes to the transferability potential of the OSH approaches featured here.

This case study intends to highlight the way in which the development of innovative construction solutions and a successful OSH approach may facilitate sustainable development through renewable power investments, safer and healthier workplaces in the construction sector and cleanerȐ environmental conditions.

3. References, resources:

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