



REPORT

D5.2 Report on certification support for 1st street lighting project:

Energy saving street lighting in the municipality of Ihtiman

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Description of players

Project owner: Ihtiman Municipality

The pilot project was implemented in the Ihtiman Municipality, situated in Southwestern Bulgaria within the District of Sofia. Ihtiman Municipality encompasses 28 settlements with a total area of approx. 516 km² and housing 18 380 people.

Project developer: Sofena

SOFENA Ltd. is a company registered under Commercial Law in 2005, with the main activity of performing energy audits of buildings, industrial systems and lighting systems. The company is owned by Sofia Energy Agency (founded in 2001 under a contract between Sofia Municipality and the European Commission) and uses the full expertise and technical potential of the Agency. It is entered in the registers under Art. 44 and Art. 60 of the Energy Efficiency Act respectively for auditing and certification of buildings and for the inspection of industrial systems.

The consultants at SOFENA Ltd. have more than 10 years of experience in the field of energy efficiency audits and have rich professional experience in the field of building constructions, electrical engineering, heat engineering and power engineering. Over 100 energy efficiency audits have been carried out, and the company has also participated in several national and European projects.

The company also provides consulting services in the field of energy efficiency, optimization of systems and processes in industrial enterprises and buildings, use of renewable energy sources and implementation of energy management systems according to BDS EN ISO 50001: Energy management systems. SOFENA Ltd. performs technical and economic analyses and consultations for the application of enterprises and owners of buildings for European and national financing, including credit lines and the Energy Efficiency and Renewable Energy Fund.

In-country advocate: Denkstatt Bulgaria

Denkstatt is the leading sustainability advisory in Central and Eastern Europe, providing guidance on sustainable development. The Bulgarian office was established in 2007 and it currently has 15 employees. Our core team of committed professionals enables us to deliver a high level of quality, further enhanced through streamlined internal collaboration. Denkstatt has substantial experience in the Eastern European sustainability policy agenda, as well as practical experience in sustainability implementation across various industries. Denkstatt Bulgaria have delivered services in environmental policy assessments, emissions inventories, climate change mitigation and adaptation plans, LCA studies across various industries, environmental and social impact assessment, as well as stakeholder engagement, both at the local and international level. Our work combines the company's deep environmental knowledge with top-line stakeholder management and on-the-ground policy knowledge. Denkstatt's customers range from governmental institutions, NGOs, metals and mining, telecom, food and beverage, pulp and paper, retail and consumer goods industries to energy supply companies and service companies.



Quality assurance assessor: Verco

Verco is a sustainability and climate change consultancy, based in the UK, with 30 years of experience with focus on low carbon growth, energy efficiency and clean energy development, including experience of developing finance programmes. Its two main roles on ICP Europe are to provide EU-wide technical support, and to provide in-country advocacy for the project in the UK. Its technical role includes leading the development of the protocols and supporting tools, supporting the delivery of training to ICP credentialed Project Developers and Quality Assurance Providers, and providing Quality Assurance to projects seeking the Investor Ready Energy Efficiency certification.

Description of project

Description of the ECM

Ihtiman Municipality’s street lighting system is distributed throughout 16 consolidated settlements¹, tailored in terms of control panels according to the number of luminaries and the scope of the road network. Prior to the ECM, the majority of existing street lighting consisted of compact fluorescent lamps (CFLs) of 1x18, 1x36 and 1x55 Wattage, as well as high-pressure sodium vapor lamps (HS) with of 1x50 and 1x70 Wattage. There are 4496 luminaries in total, distributed as per Table 1.

Table 1: Distribution of lighting fixtures and installed capacity per consolidated settlement in Ihtiman Municipality. Installed capacity inclusive of losses for each fixture (up to 20%).

No	Settlement	CFLs 1x18W	CFLs 1x36W	CFLs 1x55W	HS 1x50W	HS 1x70W	Total count	Installed capacity (kW)
1.	Ihtiman	227	655	249	141	70	1342	63.484
2.	Mirovo	47	29			36	112	5.334
3.	Stambolovo	192	58				250	6.776
4.	Chernyovo	160	142				302	9.768
5.	Polyantsi	56	82				138	4.840
6.	Venkovets	61	21				82	2.266
7.	Boeritsa	67	100				167	5.874
8.	Zhivkovo	123	122			23	268	10.006
9.	Verinsko	80	100		42		222	8.722
10.	Boryka	64	103				167	5.940
11.	Paunovo	72	65				137	4.444
12.	Kostadinkino	167	13				180	4.246
13.	Vakarel	318	250			80	648	24.716

¹ Administratively, there are 28 settlements in Ihtiman Municipality in total. Some are considered *mahalas*, i.e. very small villages de-facto acting as neighbourhoods of other settlements.



Table 2: Distribution of lighting fixtures and installed capacity per consolidated settlement in Ihtiman Municipality. Installed capacity inclusive of losses for each fixture (up to 20%). (cont.)

No	Settlement	CFLs 1x18W	CFLs 1x36W	CFLs 1x55W	HS 1x50W	HS 1x70W	Total count	Installed capacity (kW)
14.	Buzyakovtsi	165	18		5		188	4.727
15.	Belica	90	66				156	4.884
16.	Muhovo	79	58				137	4.290
	TOTAL:	1968	1882	249	188	209	4 496	170.317

The pilot project is implemented throughout the settlements listed in Table 1 and consists of replacement of all luminaries with energy-efficient LEDs while maintaining the existing control system (relays with clock), as outlined in Table 3.

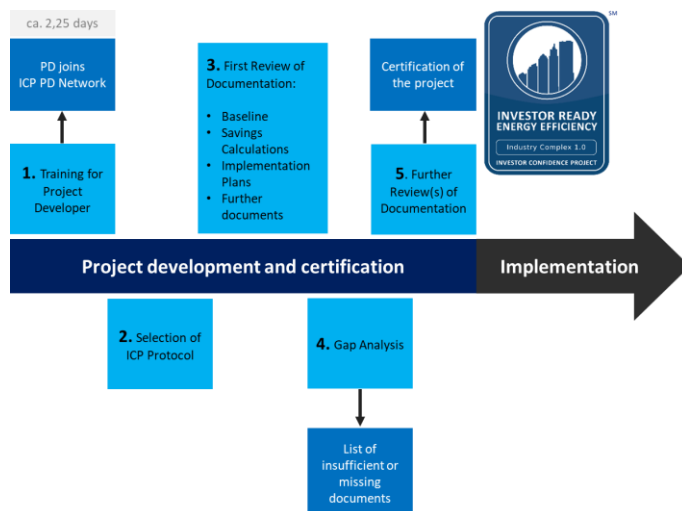
Table 3: Outline of the ECM implemented in the Ihtiman Municipality pilot project.

Luminary type	#	Power (W)	Installed capacity (kW)
LED luminary 14W	4069	14	56.97
LED luminary 18W	298	18	5.36
LED luminary 26W	38	26	0.99
LED sphere 35W	91	35	3.19
Total	4496		66.50

Steps taken for certification support

Overview of the process

The following chart shows the general ICP process for project development, quality assurance and project certification – as applied in this pilot project:



Project identification, MoU and kick-off

Over the course of IC3P, Denkstatt Bulgaria approached several potential PDs with tailored offers for support for pilot implementation of an IREE project certification. Sofena was one of the approached organisations – a street lighting and industrial installations project developer, who wished to learn how to apply the ICP Street Lighting protocol.

In order to minimise upfront investment, Sofena wished to retroactively apply the IREE certification process to a project in Ihtiman Municipality (implemented end 2018/beginning 2019) in order to test the ICP approach for future street lighting projects. Denkstatt Bulgaria and Sofena signed a Memorandum of Understanding, outlining the following:

- Denkstatt Bulgaria shall act as a liaison between Sofena and ICP, shall maintain regular communication with Sofena, provide feedback and advice on project implementation, as well as provide clarification on all technical and administrative matters as required.
- Sofena shall undertake PD accreditation as per ICP requirements.
- Denkstatt Bulgaria shall develop Bulgarian templates for M&V, Operations, Maintenance and Monitoring, and Commissioning plans, to be used by Sofena experts.
- Sofena shall prepare project documentation for the Ihtiman Municipality project in line with ICP Street Lighting Protocol, to be reviewed by an ICP Quality Assurance Assessor (Verco) and remedial measures to be carried out if needed.
- Denkstatt Bulgaria shall translate all project documentation prepared by Sofena.
- Denkstatt Bulgaria shall liaise between Sofena and the ICP QA.

Application of ICP

For leading the application of ICP to the Ihtiman Municipality project, Sofena nominated energy expert Dr. Eng. Zdravko Georgiev as their designated representative, with the process kicking off after signing of the MoU between Sofena and Denkstatt Bulgaria. The whole certification process lasted between March-October 2019, but this is inclusive of a delay on part of Sofena due to workload on other projects.

Review of ICP requirements and the project documentation showed that the bulk of the work for preparing the necessary documentation would stem from aligning the requirements of the ICP five-stage process (Figure 1) with the work done in the project’s Energy Audit - said audit is carried out as mandated under relevant Bulgarian legislation, thus the process of alignment with ICP requirements serves as a learning for the feasibility of ICP Protocols for subsequent developments.



Figure 1: The ICP five-stage process for project development.



Sofena also kicked off preparation of OMM and Commissioning plans, where it was envisioned that the work would establish whether Sofena's internal project management procedures adhere to the requirements for preparation as per ICP.

Training and PD Network Registration

Sofena's designated representative undertook and successfully completed the ICP Online Training Webinar on 24th of May 2019 and Sofena submitted documentation for joining the ICP Project Developer Network for Street Lighting on 29th of July 2019.

Sofena estimate about 2 man-days for attending developer training, studying the requirements of the ICP framework and the Street Lighting protocol, as well as submitting the required documentation for joining the Street Lighting PD Network. Throughout this process, Denkstatt Bulgaria (as the in-country ICP advocate) served as a point of contact for Sofena, providing support on questions relating to the training and registration process – such as required qualifications, declaration of honour etc., in coordination with the ICP Technical Team.

Verco reviewed Sofena's application to join the ICP PD Network for Street Lighting (a pre-requisite for project certification) – reviewing the academic and professional qualifications of Sofena's designated energy expert and their Declaration of Honour.

Aligning the project Energy Audit documentation with ICP Protocol requirements

Baselining

The approach used for savings calculation in the project Energy Audit was found to adhere to IPMVP Option B "Whole facility" (meeting ICP requirements), with savings determined based on metered data from street lighting system cartridges in all settlements where the ECM was to be implemented – the reliability of the data is assured by the fact that said cartridges are registered and undergo metrological audits as per Bulgarian law.

The base year chosen was 2017, with the base period being 12 months immediately before the decision to introduce energy-saving measures. Baseline power consumption was determined to be 994 721 kWh – no normalisation was deemed necessary as the entire lighting stock would be undergoing replacement without any expansion. Adjustments were also not carried out – the operating parameters of the lighting network were deemed to have not changed, and there was no need to adjust for downtime due to blown out fixtures as the network has been upkept well (fixtures fixed in a matter of 1-2 days).



Savings calculation

The energy expenditure of the Ihtiman Municipality lighting network for the base period was calculated based on:

- The known stock of luminaries and their installed capacity (Table 1)
- Assuming 4100 hours of operation per annum - as per the technical specification of the provider of the time relay used for the street lighting
- Taking into account losses – losses in luminaire control gear (up to 20%, noted in the installed capacity in Table 1) and losses due to theft and leakages (est. 29.7%).

Energy expenditure at the baseline (p.a. 2017) estimated at 994 721 kWh. Costs w/o VAT estimated at 142 024.31 BGN using a price of 0.143 BGN/kWh (average annual tariff as per commercial metering and invoicing).

Expenditure and costs post-ECM were calculated as follows using an identical cost of BGN/kWh and operating hours p.a., with 7.5% losses assumed stemming from the technical specifications of the lighting control equipment (Table 4).

Table 4: Energy consumption and costs after ECM implementation.

Luminary type	#	Power (W)	Installed capacity (kW)	Operating hours	Consumption (kWh)	Expense excl. VAT (BGN)
LED luminary 14W	4069	14	56.97	4100	233 561	33 399.17
LED luminary 18W	298	18	5.36	4100	21 992	3 144.91
LED luminary 26W	38	26	0.99	4100	4 051	579.26
LED sphere 35W	91	35	3.19	4100	13 059	1 867.37
Losses 7.5%					20 365	2 912.26
Total	4496		66.50		291 904	41 902.96

Given the baseline costs as stated above, the ECM is expected to bring savings of 702 816.7 kWh/year and 100 121.35 BGN/year – i.e. approx. 3.4 times reduction in energy use and costs, assuming that the statutory 7.5% loss rate is maintained.

Investment costs are calculated based on fixed cost quotations from technology providers, totalling 749 237,45 BGN (incl. 3% contingency). A payback period of 5.6 years is calculated, the ECM financed via an ESCO agreement.

Implementation plans

As required by the ICP Street Lighting protocol, Sofena developed the following three plans with support from Denkstatt Bulgaria:



<p style="text-align: center;">Operational Performance Verification (OPV)</p> <p style="text-align: center;">Plan</p> <p>Ensure that ECMs are installed correctly and capable of achieving the predicted energy savings</p> <ul style="list-style-type: none"> • Qualified OPV professional • Process targeted at implementation of ECMs • Training plan, systems manual 	<p style="text-align: center;">Operations, Maintenance & Monitoring (OM&M)</p> <p style="text-align: center;">Plan</p> <p>Systematic monitoring of energy system performance and implementing corrective actions</p> <ul style="list-style-type: none"> • Ongoing management regime • Performance indicators • Responsibilities, processes • Training plan, user manual 	<p style="text-align: center;">Measurement & Verification (M&V)</p> <p style="text-align: center;">Plan</p> <p>Comparison of actual and predicted performance to calculate the energy savings</p> <ul style="list-style-type: none"> • Qualified M&V professional • M&V Plan according to IPMVP <ul style="list-style-type: none"> – Whole facility (Option C) – Part of facility (Option A/B)
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Project-specific support/reviews and quality assurance

Throughout the entire project certification process, Sofena communicated with Denkstatt Bulgaria, who liaised with Verco in order to prepare and quality-assure all relevant documentation.

Denkstatt Bulgaria’s engagement throughout the project’s accreditation was facilitated via regular contact with Sofena’s representative (in-person meetings, e-mail and telephone), Denkstatt Bulgaria providing support and addressing queries on all matters pertaining to the project accreditation, most importantly to do with aligning the project’s statutory Energy Audit documentation with ICP requirements, including highlighting gaps and offering suggestions for addressing these. The process of accreditation included the following milestones (major project updates):

- 14 March 2019: Work on the project started with GAP analysis based on the provided energy audit;
- 10 April 2019: First teleconference call between PD and QA provider in order to discuss project approach;
- 9 August 2019: PD application process finalised;
- 19-25 August 2019: First draft of IREE application documents provided by PD;
- 4 September 2019: First feedback from QA provider received;
- 7 October 2019: Second draft of IREE application documents provided by PD;
- 24 October 2019: Second feedback from QA provided received;
- 27 October 2019: Third draft of IREE application documents provided by PD;
- 29 October 2019: IREE project certification received.

As Sofena undertook their work in Bulgarian (incl. using the Bulgarian version of the ICP Street Lighting protocol), Denkstatt Bulgaria prepared Bulgarian versions of the project documentation and subsequently provided translation support throughout the accreditation process.



Verco provided quality assurance for the project supporting Sofena with developing the required documentation in liaison with Denkstatt Bulgaria. Feedback was provided in a review tool, in spreadsheet format, which was created by Verco to cover each of the new protocols developed. The review tool generates the specific documentation requirements depending on the protocol being followed, and, as well as providing a record of which documentation has been submitted, it also provides a means of providing feedback to the project developer on any deficient areas. Two rounds of comments were issued in total for the project, in addition to various direct correspondence between the PD and QA, liaised by Denkstatt Bulgaria.

In addition to the documentation review, Denkstatt Bulgaria provided specific input on the contents of the three plans, the selection of the most appropriate Measurement & Verification approach, as well as guidance on if and how the project statutory Energy Audit aligns with ICP requirements.

Status

The project became the first lighting project to receive the Investor Ready Energy Efficiency™ certification on 29.10.2019. The major outcome of the project is the successful alignment of statutory documentation necessary for street lighting development projects with the requirements of ICP Street Lighting protocol, which Sofena plans to potentially utilise in future lighting projects.

Lessons learnt

The main outcome of the project is the alignment of ICP Street Lighting requirements with the statutory documentation and project process under Bulgarian legislation. Important lessons learnt that facilitate the successful uptake of ICP include:

- An existing relationship between the PD and the project owner can significantly expedite successful project completion.
- An existing project mandate - in this case full lighting network refurbishment financed via ESCO – for which ICP certification is a valuable add-on for the project owner.
- Sufficient technical background for the PD allowing for quick take-up of ICP requirements and alignment with existing ways of work.
- Additional effort required is limited – estimated at 6-7 additional days on top of statutory requirements, though this including the learning process itself, i.e. would be lower in subsequent projects.
- No additional costs are entailed apart from the additional effort for ICP documentation.
- The above however should be contrasted against the additional effort for document translation in the project QA process, given the current lack of a Bulgarian QA provider. However, the translation and dissemination of the Bulgarian versions of the Protocols, project application templates (plans) and training materials significantly reduced the required efforts from the project developer for developing the project documentation.



Benefits of the project certification for the client

Apart from the cost and energy savings, ICP accreditation could potentially provide a good additional framework for securing the ESCO agreement that the project is financed by. From the alignment of statutory Bulgarian requirements and the requirements of the ICP Street Lighting protocol, it has been noted that ICP puts stronger focus on project management, project ownership and quality assurance, which can lend additional credence to a planned project apart from its purely technical aspect, as well as guarantee the veracity of the technical claims themselves.

