

NPA GLOW2.0 - Green Energy Technologies for Tourism Growth



Deliverable 2.4.1 Learning Journey Learnings

(30.7.2025)

Interreg



Co-funded by
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GLOW2.0

Northern Periphery and Arctic

Introduction

The objective of NPA GLOW2.0 – Green Energy Technologies for Tourism Growth project is to support enterprises and public organisations in developing tourism flow during the dark autumn and winter months, using darkness of nature and Dark Sky as additional elements for diversifying the tourism package, while effectively communicating light pollution and ways to prevent and reduce it. GLOW2.0 activity A2.4 aimed to identify the learning journey in each of the regions in the adoption of the relevant technology solution that has been created in that region. The goal was to map new ways darkness and dark skies could be made more attractive for tourism, most importantly through technological solutions. To design the learning journeys, results of project Work Package 1 - Capacity building to develop training modules – were utilised.

As a first step to designing the Learning Journeys (LJ), all GLOW2.0 partners in collaboration, drafted a survey with the aim to identify and verify the needs of target audience (Activity A1.1). The survey was available for respondents in five languages i.e., English, Finnish, Norwegian, Icelandic, and Irish Gaelic. Partners worked actively for the survey. As the Dark Sky concept was new, different methods were used to engage target groups among other discussions, workshops, and interviews across the various participating regions. Regional language options eased engaging target groups and driving participation. A total of 99 responses to survey were received by the survey deadline. The survey helped partners understand the then state and needs of target groups. After the survey deadline, partners started working with A1.2. Creation of a formal capacity building and training programme which incorporated also mapped needs for learning journeys (Activity A2.4). The results helped design the Learning Journey framework.

Survey results

90% of all respondents that answered the survey saw potential in marketing darkness related products and services.

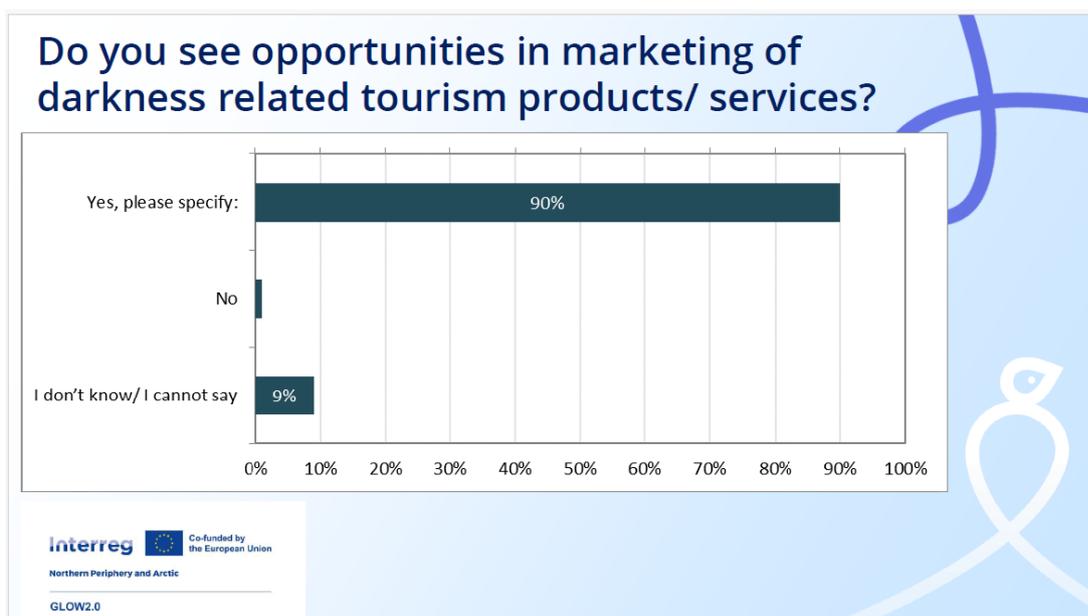


Figure. Respondents' views about opportunities in marketing darkness related products and services.

Tourism products and services associated with dark sky and darkness of nature such as star gazing, night photography, and northern lights watching were also known to majority respondents (n = 99).

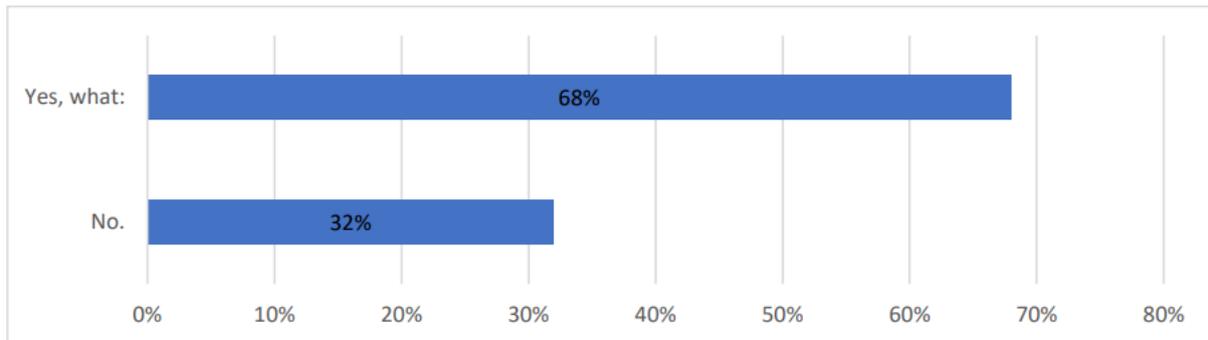


Figure. Survey responses on opportunities for marketing darkness related tourism offering.

When asked about issues that make it difficult for them to develop darkness related products, over 75% mentioned the lack of financial resources. Lack of interest or understanding by destination management organisations were also mentioned as barriers by 31% of the respondents.

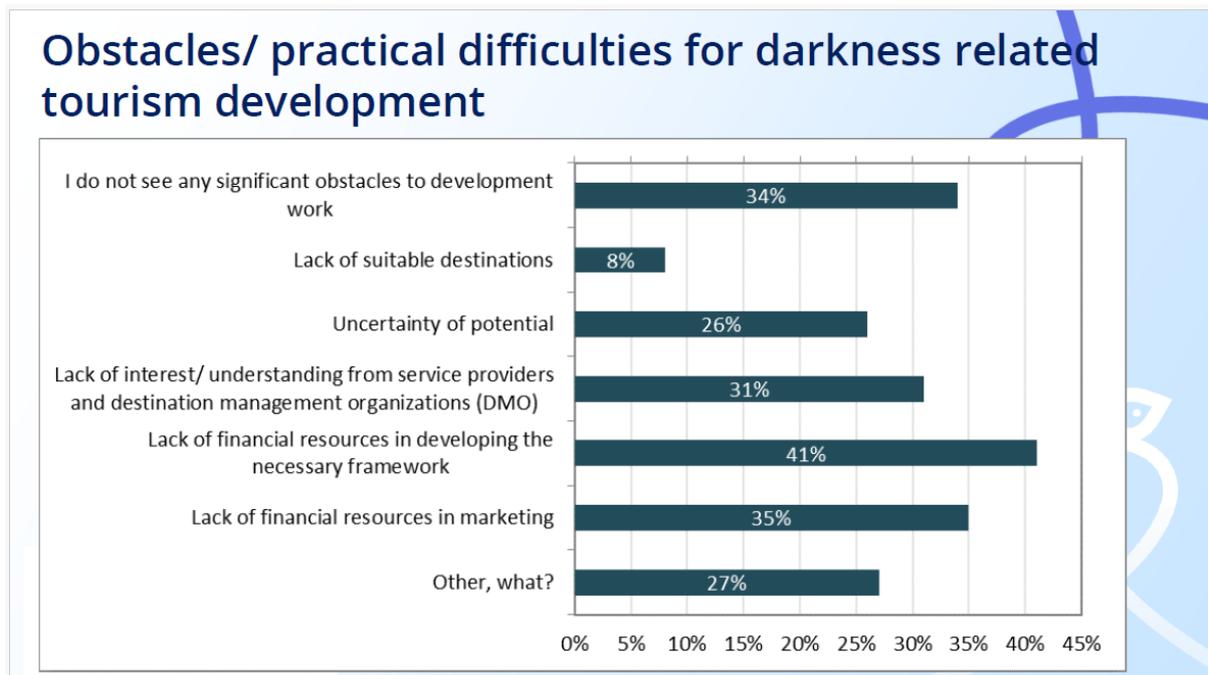


Figure. Surveyed respondents' views on obstacles or practical difficulties in developing darkness related offerings.

Other obstacles were for example:

- Unstable and patchy broadband in rural areas where dark skies tourism is likely to occur.
- Evidence-based information on the effective use of the technology.
- threshold to apply technology, staff training, expensive programming costs if there is a need to customize applications.
- lack of knowledge about technological solutions.

- the development of mass tourism destinations which create light pollution preventing other businesses in the area from developing services that require dark light pollution free skies.
- There is a lack of suitable and inspiring products and perhaps there is no enthusiasm for developing them.
- General political and social climate to protect dark skies.
- Lack of awareness of the topic, no necessary visibility/knowledge on the topic.
- There is currently a lack of information. What is dark tourism and what concepts can it include.
- unpredictable weather conditions.
- insurance costs for activities.
- lack of road services.

The views on technologies potential to support tourism was asked. Respondents felt that **advanced digital solutions e.g. mobile apps, virtual reality applications**, does offer added value to tourism. For example, it was viewed that digital solutions **can encourage visitors to explore more of what the region has to offer** (score 4/5), **help increase visitor numbers** (score 3.9/5) and **empower tourism to become competitive** (score 3.9/5). Technologies were also to some extent considered useful in encouraging visitors to stay longer at destinations (score 3,6/4).

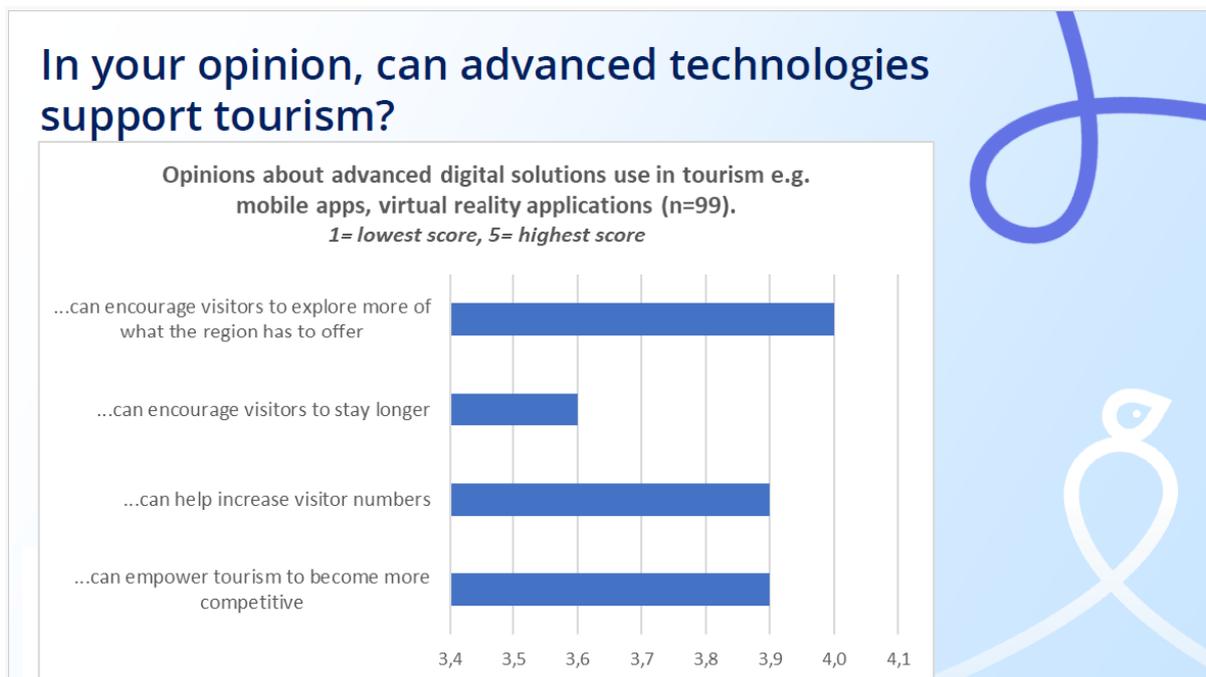


Figure. Surveyed respondents' views on advanced technologies possibilities to support tourism.

Even though technological solutions were considered an asset for tourism, technology-based solutions (e.g., websites, mobile apps, virtual reality applications etc.) used to deliver night sky-type experience such as star gazing, northern lights watching, etc were not known to most respondents (n = 99). 56% of all respondents had no knowledge of digital solutions.

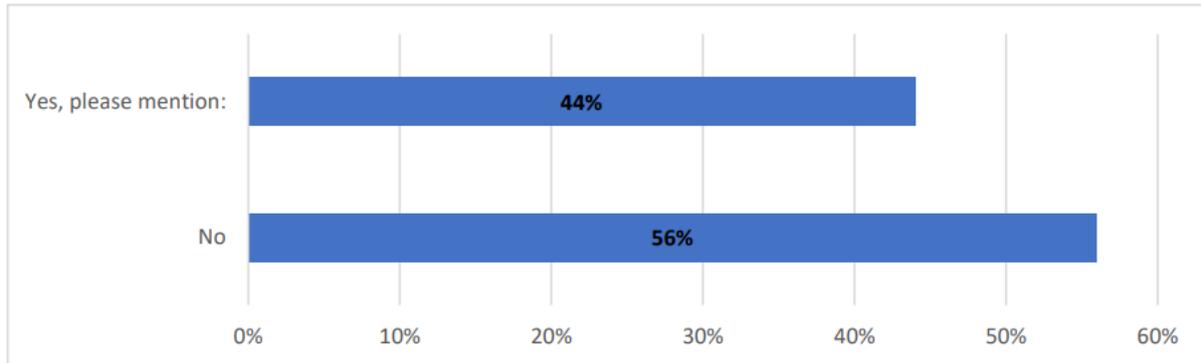


Figure. Surveyed respondents' knowledge of technology-based solutions (e.g., websites, mobile apps, virtual reality applications etc.) used to deliver night sky-type experiences.

There were variations across the regions about key interest areas for competence development.

| Interest in dark sky tourism development per region | Yes | No |
|--|------------|-----|
| Finland (n=60) | | |
| how immersive technologies could be used to develop own service offers | 77% | 23% |
| light pollution | 68% | 32% |
| how to use dark skies as added value to current service offers i.e., help with service design/ marketing for dark skies tourism offers | 95% | 5% |
| Dark Sky certifications | 75% | 25% |
| Ireland (n=23) | | |
| how immersive technologies could be used to develop own service offers | 87% | 13% |
| light pollution | 83% | 17% |
| how to use dark skies as added value to current service offers | 96% | 4% |
| Dark Sky certifications | 96% | 4% |
| Norway (n=7) | | |
| how immersive technologies could be used to develop own service offers | 71% | 29% |
| light pollution | 43% | 57% |
| how to use dark skies as added value to current service offers | 71% | 29% |
| Dark Sky certifications | 57% | 43% |
| Iceland (n=9) | | |
| how immersive technologies could be used to develop own service offers | 44% | 56% |
| light pollution | 33% | 68% |
| how to use dark skies as added value to current service offers | 78% | 22% |
| Dark Sky certifications | 56% | 44% |

Figure. Surveyed respondents' competence development interest areas.

All in all, **the most important interest across all regions** was that **all respondents wanted to learn how to use dark skies as added value to current service offers** (over 90%).

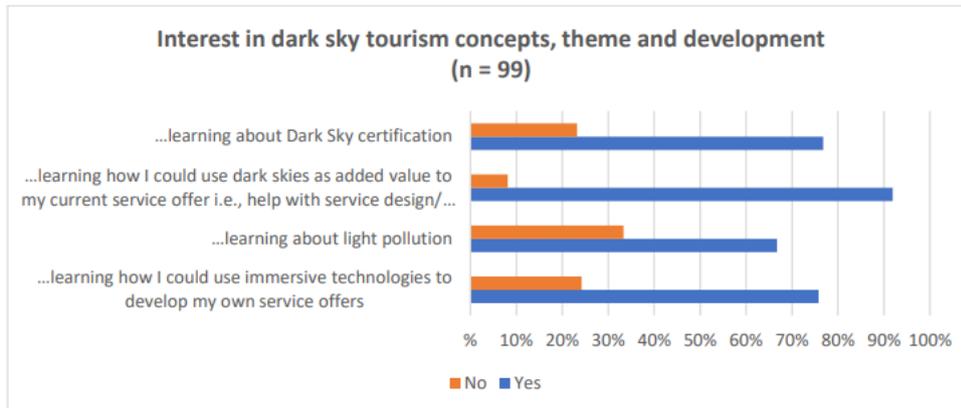


Figure. Combined data on respondents interests from all regions.

Based on the work in project Work Package 1, the learning journey in each region in the adoption of the relevant technology solution were mapped. The learning journeys were designed for Northern Periphery and Arctic (NPA) area SMEs from Finland, Ireland, Iceland, and Norway. GLOW2.0 survey ([link to document](#)) formed basis for mapping needs and designing the Learning Journeys. The goal of GLOW2.0 Learning Journeys was to enhance SMEs capacity in dark sky tourism development possibilities, with an emphasis on technological solutions. The other goal was for partners to map the adoption of relevant technology solution in each region. The aims were that at the end of a learning journey:

project partners would:

- (1) map learning in each region in the adoption of the relevant technology solution.
- (2) test, get feedback and share new ideas for development of GLOW2.0 virtual planetarium.
- (3) report upon learning journey for the relevant technology solutions.

stakeholders/ target groups would:

- (1) learn about technology solutions that could support the marketing or delivery of their product/service to the Dark Sky's tourism economy.
- (2) learn from other regions developments in this field; gain new ideas and take own old ones forward.
- (3) bring them together to share experiences and learn from each other and building networks.

The learning Journeys complemented GLOW2.0 Capacity Building workshops and events for enterprises and organisations on immersive and other technology development needs and Service Design processes taking place in own regions, and jointly organised events such as joint webinars.

Planning of GLOW2.0 Learning Journeys

Partners jointly discussed the Learning Journey plans during the project's kick-off and physical meeting that took place at the very beginning of the project; in period 1. During the planning meeting, it was considered cost friendly to combine learning journeys with partner meetings (physical/ in-person meetings). Since physical meetings were to take place twice a year, some would be combined with learning journeys or other project activities. It was also suggested that the meetings, at least those combined with learning journeys, be scheduled during dark skies periods. The preliminary dates were decided as follows:

- Physical meeting 1. Finland (North Karelia): 22-23rd February 2023, partner meeting.
- Physical meeting 2. Ireland: Sept 2023, partner meeting combined with learning journey.
- Physical meeting 3. Norway: tbd 2024, partner meeting combined with learning journey.
- Physical meeting 4. Iceland: tbd, partner meeting.
- Physical meeting 5. tbd, partner meeting
- Physical meeting 6. Finland (Lapland): partner meeting combined with learning journey.

Before organising of first learning journey, the Lead Partner, Karelia University of Applied Sciences, prepared and presented to partners a PP presentation about "How to Conduct a Successful Learning Journey". This kickstarted the process and all partners jointly worked with the learning journey programmes led by the partner hosting the Learning Journey event with help from Lead partner. Each partner worked on travel plans, attracting stakeholders to participate, and joining of the learning journeys.

Even though the Learning Journeys (A2.4) activity was initially promised until end of project period 3 (Nov 2023), based on the needs of stakeholders analysed during project period 1 and reported under deliverable D1.1.1 Specification of capacity training programme, decision to run these hand in hand with regional events, and tourism seasons variations across participating countries, partners considered it very important to request the NPA change of delivery period from P3 to P5, to allow partners get best learning outcomes that enhance also other project activities. The learning journeys were realised as follows:

- Learning Journey Ireland: Belmullet - Mayo, September 2023 during project period 2
- Learning Journey Norway: Narvik, February 2024 during project period 3
- Learning Journey Iceland: Blönduós, October 2024 during project period 4
- Learning Journey Finland: North Karelia, March 2025 during project period 5

This report presents these various types of Learning Journeys undertaken in the adoption of the relevant technology.

Learning Journey Ireland

The first Learning Journey (LJ) took place during project period 2, 12.-13.9.2023, in Belmullet, Mayo Ireland.

|  Belmullet, County Mayo, Ireland. | | | |
|---|---------------------|--|--|
| Date | Time | Partner Agenda | Stakeholder Agenda |
| 12 th September | 9.00 am | Meeting in Aras Inis Gluaire, Belmullet, Co. Maigh Eo (F26 W5H0) <ul style="list-style-type: none"> ➤ Project Management (including financials) Update & discussions ➤ Work Package 1 ➤ Work Package 2 | 9.30 Start Meeting in Aras Inis Gluaire, Belmullet, Co. Maigh Eo (F26 W5H0) Anne Conlon: Brief presentation from the following: <ul style="list-style-type: none"> ➤ Terra Firma Ireland ➤ Kerry International Dark Sky Reserve ➤ Syrjävaara Dark Sky Park & Nature Reserve and Arctic Stargazing Tours |
| | 11.00 am | Tea/Coffee | Tea/Coffee |
| | 11.20 am – 1.00 pm. | <ul style="list-style-type: none"> ➤ Update & discussions Continued | <ul style="list-style-type: none"> ➤ Speed Dating for SME's |
| | 1.00 pm – 2.00 pm. | Tea & Coffee / Sandwiches to be supplied | |
| | 2.00 pm - 5.00 pm. | Depart Aras Inis Gluaire and travel to Eachléim <ul style="list-style-type: none"> ➤ Blacksod Lighthouse (F26 KC7V) ➤ SOLAS - visitor attraction. (F26 X316) | |
| | 7.00 pm | Dinner – Talbot Hotel, Belmullet, County Mayo | |
| 13 th September | 9.45 am | Broadhaven Hotel Update and Discussions <ul style="list-style-type: none"> ➤ 9.45-10am Introduction (Sean) ➤ 10 am-10.30 Georgia: Criteria for Certificate: Work Package 3 ➤ 10.30 -11.30 Marius: Demo VR Technology Taster Tea & Coffee ➤ 11.45- 12.00 Marius ➤ 12.15- 1.00 pm Kerem Asfuroglu: *Times to be finalised with speakers | |
| | 1.-2 pm | Soup & Sandwiches at Broadhaven Hotel. | |
| | 2.30 pm – 4.30 pm | Travel for Site Visit Tour at Wild Nephin National Park Ballycroy & walkway Tea & Coffees & Treats | |
| | 4.30 pm – 5.00 pm | Feedback from Stakeholders /AOB | |
| | 7.00 pm | Dinner at golf course | |
| 14 th September | 9.30am | Depart for Airport 9.30am | |

Figure. GLOW2.0 Ireland Learning Journey Programme.

All partners were involved in the development of Ireland's Learning Journey programme. Partners jointly discussed the Ireland plans and programme. The Learning Journey was combined with the physical partner meeting. All partners worked with attracting stakeholders to join the event. Partners also worked with own and own stakeholders travel arrangements such as arranging flights and accommodations, providing meals and other info to host partner, keeping stakeholders updated about plans updates, and taking stakeholders to Ireland.

The project Lead Partner (LP), Karelia University of Applied Sciences (Karelia UAS), helped the Ireland partners, Údarás na Gaeltachta (Udaras) and WestBIC, with curtailing of the programme in line with goals and aims of the LJ, working with budgets and costs, and producing consent forms and other materials for the event. Karelia UAS also shared the [GLOW2.0 video](#) for communication during learning journey event. As hosts of the event, the Ireland partners (Udaras with help from WestBIC) had huge workload onsite, taking care of the arrangements, and assisting The University of Norway (UiT) partner with GLOW2.0 Virtual Planetarium planning and set-up in time for the LJ.

On the first day of Learning Journey in Ireland, on 12.9.2023, 15 regional SMEs from Ireland and stakeholders taken along by other project partners joined together in a seminar/workshop event. The workshop took place parallel with project partner meeting. While stakeholders had a forum to discuss, learn from one another and network for tourism, in a parallel session, partners were able to follow on work progress and make plans for next phases of the project.



Figure. SMEs engagement networking, information & testing sessions during seminar/LJ in Belmullet, Mayo, Ireland.

The stakeholder workshop featured case studies from local businesses providing valuable insights, a brainstorming session and knowledge exchange. This event successfully expanded SMEs network of businesses eager to explore opportunities in dark sky tourism. The event included testing demo-version of immersive technology. [GLOW2.0 video](#) showcasing what immersive technologies can offer for regions and businesses was also showed during the event. After joint lunch, partners and stakeholders joined up to explore together and learn about the tourism development opportunities and challenges in Mayo region. Stakeholders also got to test the raw version of the GLOW2.0 virtual planetarium (VP) being developed by the project. The participants got acquainted with:

- Interactive light pollution map that can be used for estimating scale of light pollution and potential impacts on own tourism activities via Mayo Dark Sky Park (DSP) presentation.
- Lighting design techniques and technologies for Dark Sky preservation via Ireland case studies developments presented by Dark Source lighting designer.

- Virtual Reality via testing the GLOW2.0 Virtual Planetarium application.
- Dark Sky Park concept and interactive lighting exhibition during visit to Mayo DSP.
- Impact of storytelling for heritage during visit to the Blacksod lighthouse.
- Interactive map concept in development during visit to SOLAS visitor centre.



Figure. Learning Journey participants at Wild Nephin National Park | Mayo Dark Sky Park in Ireland.

Concerning GLOW2.0 Virtual Planetarium demo, the first attempt was to locate hardware and devices in Ireland that could be utilized for the demonstration, but it turned out to be nothing available in that specific area. So, the system developer of UiT brought equipment from Norway to Ireland to use for the testing and demonstration. Design and development included the following steps:

- Choosing one of the concepts described in Activity 2.1 for piloting together with the project partners and SMEs involved in the project.
- Establishing the location and the surroundings on Earth in one of the associate partners' countries.
- Star sky recreation.
- Design interaction and adapting user experience elements to the virtual reality.



Figure (left). Picture taken in Ballycroy prior to GLOW2.0 learning journey in Ireland. Figure 3 (right). Virtual content (output 2.1 Virtual elements forming part of overall virtual planetarium) developed from scratch by GLOW2.0.

The demo version of the immersive technology (virtual planetarium) was developed and presented to the partners and stakeholders for testing and feedback.

From partner meetings, GLOW2.0 virtual planetarium testing, networking and team discussions, visiting the Blacksod Lighthouse and Solas, to listening the keynote speakers Georgia MacMillian (Mayo Dark Sky Park) and Kerem Asfuroglu (environmentally sustainable lighting designer), both partners and stakeholders left with increased knowledge and practical insights on the difference they can make regarding light pollution, ways of extending the dark sky tourism season, ways technologies can be used to enhance darkness preservations in destinations and for own service offers, and of course the importance of networking for tourism. The discussion feedback from stakeholders for the GLOW2.0 Virtual Planetarium pilot was very useful in phase II of development. The learning Journey was considered fruitful and valuable.

“In my opinion, the level of cooperation with which things were handled was significant. This is clearly only sensible way in Ireland's societal, social and cultural environment. This could also be applied in the Nordic environment, which is clearly different and more individualistic.” Feedback/ comment from learning Journey participant.

The activities onsite were coordinated by the hosting partner Udaras. WestBIC partner also worked actively with disseminating and communicating the events during that week. Partners also communicated the event in own network during and post event. After Learning Journey in Ireland, the UiT team started planning the learning journey to be held in Narvik in February 2024.

Learning Journey Norway

The second Learning Journey (LJ) took place during project period 3, 6.-7.2.2024, in Narvik, Norway.

SEMINAR
Embracing Dark Sky Tourism in
Northern Periphery and Arctic Region
February 7th 2024
Narvik, Norway
UiT Campus Narvik, Lodve Langes gate 2



PROGRAMME

9.00-10.30

- Welcoming speech by Lars Sigurd Eide, CEO/Head of Economic Development, Narvik municipality
- Northern Norway tourism – trends, challenges and requirements for technological solutions by Ann-Hege Lund and June Sollund, Visit Narvik AS
- The Northern Light Planetarium, past and present. Light Pollution in Norway – what is happening? by Anne Bruvold, astronomer, Nordnorsk Vitensenteret
- Exploring the impact of VR and planetarium experiences at Vitensenter Nordland by Georg Enga, market manager
- Feasibility study of science tourism in Northern Norway by Elina Hutton, researcher, SALT.nu

10.30 - 11.00 Coffee break and Demo VR Technology Testing

11.00-12.00

- Embracing Dark Sky Tourism in Northern Periphery and Arctic regions, by team GLOW2.0
- Stakeholders from project partner countries
- Discussion

Figure. GLOW2.0 Norway Learning Journey Programme.

All project partners were involved in development of the Norway Learning Journey (LJ). This was combined with the third project physical meeting. Partners jointly discussed the Narvik plans and programme and worked with own travel arrangements such as arranging flights and accommodations, providing meals and other info to host partner. The Lead Partner (LP) Karelia UAS helped UiT with programme planning, working with budgets and costs, and producing consent forms and other materials for the event. As hosts of the event, Norwegian partner UiT took care of the onsite arrangements. Udaras and Karelia UAS worked together on the GLOW2.0 presentation for the 7.2.2024 seminar with Norwegian stakeholders.

The event was held at UiT Campus in Narvik, Norway, on 6-7 February 2024. The hybrid workshop realised during the Learning Journey featured diverse line-up of speakers considering Northern Norway's tourism industry in different perspectives. Stakeholders such as Nordnorsk Vitensenter, Vitensenter Nordland, Narvik Kommune, Visit Narvik, and SALT joined the seminar/ learning journey event, making it a dynamic platform for collaboration and knowledge exchange.



Figure. Presentations and virtual reality demonstrations during the Narvik Learning Journey.

During the event, Narvik municipality CEO set the tone with a welcoming speech, emphasizing the importance of collaboration and innovation in driving sustainable tourism initiatives. Subsequent presentations covered a wide spectrum of topics, ranging from light pollution, tourism trends and challenges, business capacity in dark sky tourism, to technological innovations and their implications.

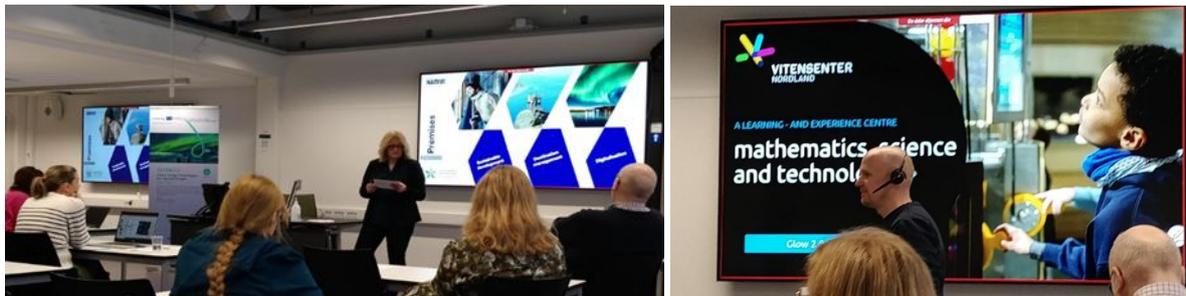


Figure. Seminar session presentations during the Learning Journey event in Narvik, Norway.

The presentations prompted considerable interest and sparked fruitful discussions among stakeholders on technical knowledge, future work, networking, and potential collaboration for sustainable tourism development. Participants also got engaged in a 2-hour long demonstration of the GLOW2.0 Virtual Planetarium and testing using VR headset. The initial idea of the Virtual Planetarium (VP) and the benefit of virtual production were introduced, such as possibility of creating endless different scenarios by tweaking parameters within the VP, such as sun, moon, stars, aurora, skies, and weather. Participants also got acquainted with immersive storytelling with use of technologies during a guided tour to the Narvik War Museum. In addition UiT gave a captivating demonstration session at the UiT Extended Reality (XR)-lab, showing the potential applications of Virtual Reality (VR) technology and possibilities for darkness and dark sky thematics.



Figure. Immersive demonstration at Narvik War Museum.

This event successfully expanded SMEs network of businesses eager to explore opportunities in dark sky tourism, as participants gained learning about:

- Light pollution in Norway and efforts to protect darkness, via case example Øvre Pasvik National Park, that could become Norway's first certified International Dark Sky Place.
- Efforts to curb bad weather impacts on phenomenon viewing experiences and provide all-year round activities via first Norwegian observatory.

- Networking for science and tourism via 13 regional science centres' cooperation.
- Technologies integration in visitor centres, their potentials and requirements.
- Northern Norway tourism trends, challenges and requirements for technological solutions, and challenges for adapting technological solutions.
- Data on Nordic visitors' familiarity with technological solutions and their interests for using Virtual or Augmented reality technological solutions during holidays/ vacations.
- Virtual Reality possibilities via testing the GLOW2.0 Virtual Planetarium application.
- Immersive solutions possibilities for tourism during UiT Extended Reality (XR) lab visit.
- Dark Sky and Darkness productisation possibilities.

Concerning GLOW2.0 Virtual Planetarium demo, a build of the VP was created, which could qualify as an alpha build of the software, as this was running as a standalone. For the testing, a build of the VP, an alpha build of the software was created, running standalone through SteamVR and to the VR headset. The development computer (Dell workstation) and the VR headset HTC Vive Pro Eye were used for demonstration and testing.



Figure. Testing various virtual elements e.g. landscape, moon, clouds, rocks, auroras and evaluating technical feasibility (Norway, Feb 2024).

This testing session on the further developed version of virtual planetarium, since previous learning journey event, provided GLOW2.0 with better understanding on how the experience may be delivered in the end. The best ways and options to enhance the experience was discussed. Additionally, types of tourists who might use the experience and the best placement options such as storytelling/ sound ambience to reach the widest audience and raise awareness about the development of Dark Sky Tourism were also considered. The session offered learning about the potential applications of Virtual Reality (VR) technology within the context of GLOW2.0 sparking enthusiasm among participants and stimulating further exploration of innovative solutions.

All in all, the learning journey was an important event for testing the next version of the immersive technology/ virtual planetarium being developed in the project with target groups. It proved beneficial, offering valuable insights on next steps. GLOW2.0 partnership communicated the results of engagements of the event with own regions target groups. Materials from the event were placed on the miniwebsite so target groups could also access and use those for developing own activities. Links to materials were also shared with participants of the joint webinar 30.4.2024 titled "Embracing Dark Skies in Northern Periphery and Arctic Region".

Learning Journey Iceland

The third Learning Journey (LJ) took place during project period 4 (8.-9.10.2024) in Blönduós, Iceland. Like previous Learning Journeys, partners jointly discussed the plans and programme. Partners also worked with own and own stakeholders travel arrangements e.g. flights, accommodations, providing meals requirements and other information to the host partner. As host of the Learning Journey event, Iceland partner SSNV had the intensive work of organising things onsite.

| | | | | |
|---|---------------|---|--|--|
| Day 1 (Tue, 8th Oct) Venue: Krúttið (4) by Hótel Blönduós | 08:30 – 12:00 | <ul style="list-style-type: none"> ▪ Project partners programme: Consortium meeting at Krúttið – Project progression and WP presentations ▪ Program for stakeholders: (Tour to Skagaströnd fishing village - 20min bus drive) "Storytelling" - when the sagas from here come alive - Museum of Prophecies Sagatráll. ▪ "LightUp" – using the darkest days for light art NES Artist Residency (neslist.is) ▪ Lunch at Hótel Blönduós. | 18:00* | <ul style="list-style-type: none"> ▪ Joint dinner at Brimslóð atelier (international stakeholders and partners) ▪ Post dinner event (Inc. bus drive) Dark Tourism vs Dark Sky Tourism - experience (Warm clothes needed !!) |
| | 13.00 – 16.00 | <ul style="list-style-type: none"> ▪ Seminar with local tourism industry: (Hybrid Event, link shared to participants) - Welcoming speech, Mr Pétur Arason - Mayor Húnaþingið - Regenerative tourism perspectives Iceland, Mrs Ólöf Ýr Atladóttir - Consultant and former Director Iceland Tourism Board - NPA tourism projects compatibility with local DMP, Mrs Arnheiður Johannsdóttir - Director Visit North Iceland - Coffee Break - Citizen science – practice example from the seal watching and reflecting it to the astronomy, Dr Jessica Aquino - Assistant professor Hólar university and Mrs Georgia McMillian - Director Mayo Dark Sky Park - Embracing darkness in lighting design, Mr Kristján Kristjánsson - Lighting Designer MSLL - Iceland at Night: Dark skies for astrotourism, Mr Sævar Helgi Bragason - Science educator and communicator - Wrap up and Q&A led by Mr Kjartan Bollason - Assistant professor Hólar university | Day 2 (wed, 9th Oct) 8:30 | <ul style="list-style-type: none"> ▪ Joint program for partners and stakeholders (Sæuárkrókur - 30 min by bus) "VR in tourism" the experience of 1238 1238: The Battle of Iceland A Virtual and Augmented Reality Museum "GLOW2.0 Virtual Planetarium" testing at 1238 Testing GLOW2.0 VP development ▪ Lunch (1238) (international & Icelandic stakeholders) & informal stakeholder networking. |
| | | | 12:15 – 17.00 | <ul style="list-style-type: none"> ▪ Departure to Reykjavík (Reykjavík - Approx. 3h by bus) ▪ Joint program for partners and stakeholders "Technologies and storytelling in tourism" Experience of Flyover Iceland. "Diversifying a museum experience" PERLAN Nature Museum. (Admission ISK 4.000 = EUR 27) ▪ Drive to Koppvö Hotel (The end of Learning Journey) |
| | | | Day 3 (thu, 10th Oct) | <ul style="list-style-type: none"> ▪ Individual departures |

Figure. GLOW2.0 Iceland Learning Journey Programme.

The Lead Partner (LP) Karelia UAS, as has been with previous learning journeys, assisted with developing of the LJ programme. The LJ plans consisted testing of the almost final content of GLOW2.0 developed Virtual Planetarium (VP) solution (A2.3). For this, Karelia collaborated with SSNV and UiT in realising the testing such that stakeholders could test it in form of a service at a tourism service provider's premises, in this case, at 1238 Virtual Reality Museum that was already competent in Virtual Reality and immersive solutions. SSNV also collaborated with Karelia UAS in realising the hybrid joint seminar event that took place on 8.10.2024 as part of the LJ. SSNV and Karelia UAS worked on the programme content, SSNV and Udaras liaised with presenters, while all partners were tasked with marketing of the seminar event.

On the first day of the event, on 8.10.2024, GLOW2.0 project partners gathered in Blönduós at Krúttið to discuss the project progress. The partner consortium meeting focused on insightful discussions about project progression and the various work packages highlighting our collaborative efforts and next steps. In a parallel session, as part of the learning journey, stakeholders from our regions got the chance to engage with one another and explore Blönduós' tourism offers.



Figure. Left: GLOW2.0 partners meeting, the rest: Stakeholders during educational and networking events.

In the afternoon, GLOW partners and stakeholders gathered together for an enriching day of insights and collaboration. Kicking off at Krúttið, Hótel Blönduós, Mayor Pétur Arason welcomed us, emphasizing the importance of sustainable and regenerative tourism in Iceland. His insights highlighted the unique challenges local communities face in balancing development and preservation. Mrs. Ólöf Ýrr Atladóttir, a former Director of the Iceland Tourism Board, discussed how regenerative tourism can promote economic growth alongside cultural and environmental sustainability. Mrs. Arnheiður Johannsdóttir, Director of Visit North Iceland, thereafter outlined how NPA tourism projects can align with local Destination Management Plans, offering a roadmap for collaboration.

After the coffee break, participants listened to presentations on citizen science and lighting design. Dr. Jessica Aquino from Hólar University shared a compelling example of citizen science through seal watching, while Mrs. Georgia McMillan, Director of Mayo Dark Sky Park, discussed the interconnectedness of ecosystems. Mr. Kristján Kristjánsson, a lighting designer, emphasized the importance of preserving Iceland's dark skies for wildlife and astrotourism, giving insights of his journey as a lighting designer now advocating light pollution to clients to enhance awareness of darkness values and benefits in protecting the night from light pollution. Kristján showed real case examples of experimental lighting and how meaningful and thoughtful lighting has been tested proving success in attracting visitors' attention.



Figure. Seminar session with partners and stakeholders during Learning Journey Iceland.

Mr. Sævar Helgi Bragason, a science educator, captivated participants with insights on astrotourism's potential in Iceland. For this, examples of his company's business model was shared to inspire others. At the same time, the developments with façade lighting and the challenges those present for guides and other tourism companies serving the night sky economy was presented. The day concluded with a Q&A session led by Icelandic associated partner representative Mr. Kjartan Bollason, fostering further discussion. Participants enjoyed a joint dinner at Brimslóð Atelier (also showcasing regenerative tourism concept), followed by a unique

experience contrasting Dark Tourism with Dark Sky Tourism, allowing participants to appreciate Iceland's stunning night sky.



Figure. Learning Journey participants in a guided night walk in Iceland.

The second day of the event focused on immersive technologies adaptation possibilities in tourism service design. After a scenic bus ride to Sauðárkrókur, the first visit was made at 1238: The Battle of Iceland Virtual and Augmented Reality Museum. This state-of-the-art facility immerses visitors in the 13th-century sagas of Iceland, showcasing the power of immersive experiences in education and storytelling. The further developed Beta version of GLOW2.0 Virtual Planetarium, since previous Learning Journey in Narvik, was also tested.

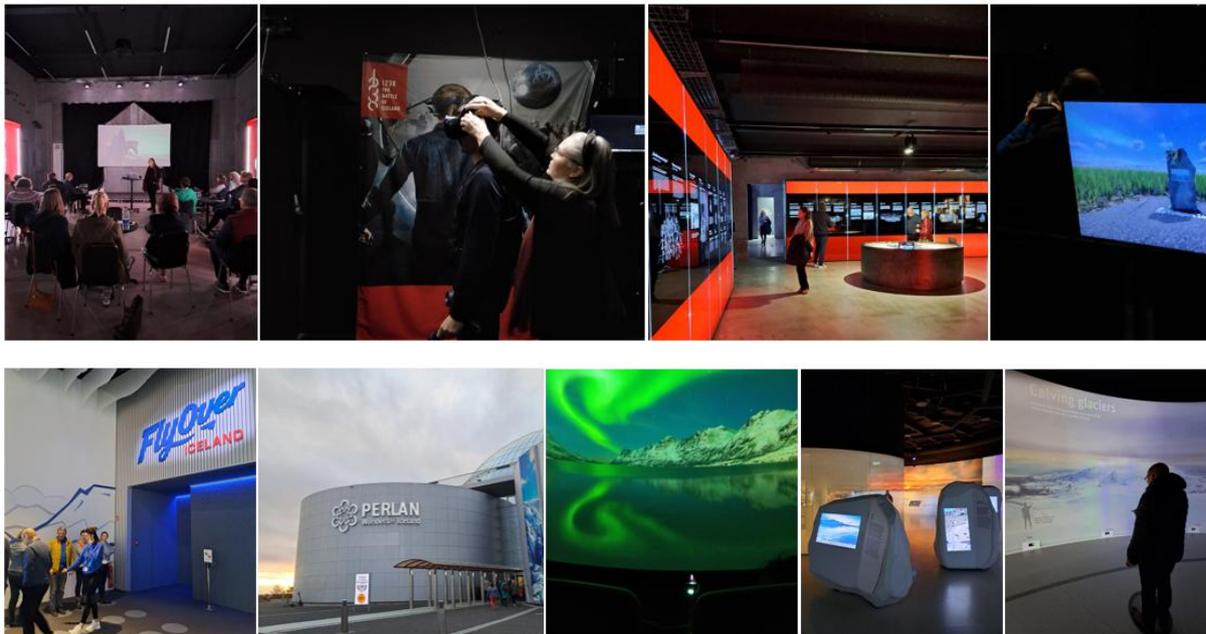


Figure. Row I. Testing Beta version and user friendliness of virtual planetarium with target group enterprises and end-users in an SME's facility in Iceland to evaluate operational feasibility e.g. standalone functionality and equipment needs. Row II. Visit to tourism destinations using technologies to enhance tourism experiences (Iceland, Oct 2024).

During the Learning Journey in Iceland and for immersive solutions in particular, participants gained insights about:

- proactive ways to preserve and engage visitors with place-based histories, linking it with other offers like museum exhibitions, during visit to 1238 - The battle of Iceland; the VR experience.
- The blend of gaming and storytelling, during visit to 1238 - The battle of Iceland; VR experience.
- immersive storytelling in service design during visit to Flyover Iceland; welcoming intro.
- immersion using sensory experiences in service design during visit to FlyOver Iceland; flying over landscapes with various engaging sensory experiences.
- replicating outdoors indoors and concept applicability for people with sensory difficulties such as hearing, sight or smell, during visit to FlyOver Iceland.
- replicating immersive experiences safely indoors, a concept applicability for people with mobility restrictions who may not be able to experience the outdoors, during visit to FlyOver Iceland.
- ways spaces and technologies can be merged to connect the outdoors indoors while arousing interest to visit many destinations (marketing), during FlyOver Iceland visit.
- using immersion via technologies to market region's strengths and offers, arouse feelings of connection to nature events, during visit to Perlan museum and FlyOver Iceland.
- using immersive experiences to provide alternative indoor experiences and learning as plan B during instances of bad weather or for people with mobility restrictions, during visit to Perlan museum.
- interactive exhibitions, during visit to Perlan museum, the volcano seats and interactive wall.
- potential of an interactive virtual planetarium experience showcasing the nightscapes and night sky elements, storytelling, and for marketing, or as plan B in instances of bad weather, during GLOW's transnational Virtual Planetarium testing.
- possibilities with location specific pre-recorded immersive planetarium experience as part of service design and plan B during bad weather, during visit to Perlan museum.
- light pollution mapping for awareness, via results presented by associated partner Dark Sky Park who brought along an immersive light pollution camera to the Learning Journey.

Participants learned how immersive technologies and experiences can be used in tourism to foster community engagement, enhance learning, elevate experiences, give deeper meaning with storytelling, used in marketing, and even as a Plan B in instances of bad weather to guarantee all-year round activities or promises kept to visitors. The varied technologies challenged participants to think about the possibilities, but also the dos and don'ts of immersive offers, and how to stay authentic and accessible while keeping it entertaining. Participants also reflected on ways these could be adapted in own regions/offers.

UiT-team held post learning journey discussions with Lead Partner, Karelia UAS, on ways to further develop the virtual content based on the feedback from the Learning Journey, and next

phase of testing during Learning Journey in Eastern Finland in spring 2025. UiT instructed on next steps, equipment needs and VP content needs from their regions. UiT-team started planning for the VP testing for period 5 (P5) at the Science Center in Mo i Rana, North Norway (Vitensenter Nordland). During P5, a computer and a headset was installed at that science center for testing and collecting of user data for the application to be delivered in May 2025.

Learning Journey Finland

The fourth Learning Journey (LJ) took place during project period 4, 25.-26.3.2025, in North Karelia, Eastern Finland. The Lead Partner (LP) of the project, Karelia UAS, hosted this final learning Journey (LJ) event. Like previous Learning Journeys, partners jointly discussed the plans and programme. Partners also worked with own and own stakeholders travel arrangements e.g. flights, accommodations, providing meals requirements and other information to the host partner. As host of the Learning Journey event, Finnish partner and project lead Karelia UAS had the intensive work of organising things onsite. Karelia worked with the programme, accommodations, meals arrangements, logistics, liaising for speakers, and communicating the event. Karelia also worked with setting up the GLOW2.0 virtual planetarium testing possibility in Finland and held meetings with UiT about this. Even though UiT was not able to join the Learning Journey in person, this gave an opportunity to test the functionality of the almost final version in a remote context and test the viability and reliability of streaming remotely.

| | | | | | | |
|--|---------------|--|---|---|--|--|
| Day 1 (Tue, 25th Mar) <i>(Check-out and bus pick-up at 8:50* from hotel to Tikkarinne Campus)</i> Event venue: Karelia UAS, Tikkarinne Campus (Address: Tikkarinne 9, 80200 Joensuu) | 09:00 – 12:00 | <ul style="list-style-type: none"> Project partners programme: Consortium meeting – Project progression and WP presentations Virtual Planetarium & Immersive technologies: Testing and discussions Lunch at Solina restaurant | Day 2 (Wed, 26th Mar) Venue: Break Sokos Hotel Koli/ PANU (Address: Ylä-kolintie 39, 83960 Koli) | 09:00 – 13:00 | Programme for partners LIEKSA <ul style="list-style-type: none"> Welcoming speech, Jason Koukku, Managing Director, Koli DMC. Managing tourism operations within a protected area, Case Break Sokos Hotel Koli, Sokos Hotels. Retkipaikka Dark Sky tourism development, Retkipaikka Jotuca Oy. Experience and feel Koli – Creating and providing experiences responsibly, Irja Tanskanen, Feel Koli. Tour of Koli Visitor Centre & Exhibition, Koli Visitor Centre Ulko. Views of Koli – short walk in Koli National Park, Guided experience by Feel Koli. Joint lunch | |
| | 13.00 – 15.00 | Seminar with local tourism industry <ul style="list-style-type: none"> 13:00 Welcoming speech 13:10 Regional culture and nature in responsible tourism offering, Helena Puhakka-Tarvainen, Entrepreneur & CEO, Lietsu Services Ltd. 13:25 The role of Biosphere Reserves in responsible tourism development & tourism networking, Vilma Lehtovaara, Coordinator, ELY-Centre North Karelia Biosphere Reserve. 13:40 Coffee Break 13:50 Observatory experiences for science and tourism - Challenges and Opportunities, Otto Huhta, Chairperson/CEO, Seulaset Ry. 14:10 Pearls of Kaavi: Dark Sky tourism development & branding, Olli Reijonen, Entrepreneur & CEO, Syrjävaara Oy & Seija Karhu, Kaavi municipality. 14:40 Dark Sky tourism compatibility with North Karelia tourism strategy – challenges and opportunities, Terhi Millar, Development manager, Visit Karelia Business Joensuu. 14:55 Wrap-up | | 13.00 – 16.00 | <ul style="list-style-type: none"> Bus departs Koli for Joensuu Visit to Venejoen Piilo Facility (Dark Sky nature and culture tourism) Arrival to Joensuu city centre (For those staying overnight in Joensuu) Arrival to Joensuu airport (For those departing for Helsinki, end of learning journey) | |
| | 15.00 – 16.00 | <ul style="list-style-type: none"> Bus drive to Koli (check-in, own time) | | Day 3 (Thu, 27th Mar) | | <ul style="list-style-type: none"> Individual departures for those staying overnight in Joensuu (City of Joensuu under the Dark Sky - List of activities to be provided for those staying overnight in Joensuu) |
| | 17:00-19.30* | <ul style="list-style-type: none"> Joint dinner at Break Sokos Hotel Koli Post dinner event Dark Sky Tourism experience in Finnish National Landscape - Koli, Guided by Retkipaikka Jotuca | | | | |

Figure. GLOW2.0 Iceland Learning Journey Programme.

Onsite, Karelia marketed the Learning Journey event, acted as seminar moderator and recorded the seminars. The hybrid seminar event “Regional and Global Approaches to Dark Sky Tourism” offered views on Eastern Finland’s tourism strategies and the possibilities to utilise Dark Skies in tourism. Helena Puhakka-Tarvainen, entrepreneur & CEO, Lietsu Services Ltd, presented ways her company integrates regional culture and nature in accommodation business to provide responsible tourism experiences for visitors. The role of regional cooperation for sustainability was also presented, coming together with other similar minded companies to cooperate in

providing responsible tourism product and services. Vilma Lehtovaara, coordinator at ELY-Centre|North Karelia Biosphere Reserve and associated partner to the project, shared the role Biosphere Reserves, most importantly North Karelia Biosphere Reserve, plays in responsible tourism development & tourism networking. In her presentation, she also shared concrete results of projects that have delivered in enhancing cooperation efforts and showcasing networking. Participants also heard from Seija Karhu, Kaavi municipality & Olli Reijonen, Entrepreneur & CEO, Syrjävaara Oy about the Pearls of Kaavi: Dark Sky tourism development & branding, implemented for a whole municipality interested in protecting the nightscapes. Olli also shared his key interest in protecting darkness and offering darkness related experiences, including his journey to certify his facility as an International Dark Sky Place.

Otto Huhta, Chairperson/ CEO of Seulaset Ry gave an inspiring presentation on observatory experiences for science and tourism, and the corresponding challenges and opportunities. Terhi Millar, Development manager at Visit Karelia| Business Joensuu, concluded the session with her talk on Dark Sky tourism compatibility with North Karelia tourism strategy, sharing potentials for the region within the Dark Skies economy. Other presentations during the event were by Jason Koukku, the Managing Director of Koli DMC who shared among other the seasonality and technological challenges faced by tourism in the region and the untapped potential for Dark Sky tourism. Participants further listened to presentations from businesses around the area. Participants also listened to the experiences of entrepreneurs that have developed Dark Sky products in the area. These were:

- Retkipaikka Oy that has developed and offers snowshoeing in the Dark experience.
- Experience and feel Koli, that offers tailored guided experiences for visitors in Koli region.
- Koli Visitor Centre, that has light pollution infotexts in its premises to enhance visitor awareness, and offers responsible hiking guidance in Koli region.
- Syrjävaara Oy, a Dark Sky facility that offers various experiences for visitors from night photography, observatory viewing, educational courses, etc.
- Seulaset Ry, that bridges science and tourism at its premises, offering cosmic shows, courses, nighttime guided astrotourism events.
- Venejoen Piilo Oy, that had developed dark sky experience and integrated an immersive 360-degree solution showcasing darkness elements.

The participants also visited the Nature Centre Ukko in Koli National Park where the GLOW infotexts are showcased. They also took part both guided daytime hike and guided snowshoeing nighttime experience within the national park. The seminar presentations and recordings are shared on GLOW mini website outputs & results subpage, under "Regional and Global Approaches to Dark Sky Tourism 25.3.2025". Karelia also planned and produced videos of the LJ. The recordings have been shared with partners and associated partners and have been made public for target groups. All in all, participants learnt:

- Greening business models by internalizing sustainability issues via Lietsu Oy.
- Importance of networking locally and regionally via Lietsu Oy and North Karelia Biosphere Reserve presentations.
- Productising Darkness via SME presentations such as Syrjävaara Oy, Seulaset Ry, Feel Koli Oy, and taking part the Retkipaikka Oy snowshoeing experience in Koli National Park.
- Responsible visitor guidance and awareness actions via Koli Visitor Centre, that has light pollution infotexts in its premises with design assistance from GLOW2.0 and offers responsible hiking guidance in Koli region.
- Needs for certifying a Dark Sky facility via Syrjävaara Oy presentation.
- Process and needs of branding darkness for large areas, e.g. provinces or communities via Kaavi Municipality presentation.
- Dark Sky tourism development as part of developing sustainable tourism, via presentation of Kaavi municipality's journey from development to branding Darkness.
- Immersive 360-degree solution as part of service design, via Venejoen Piilo Oy that had developed dark sky experience and integrated it as part of own offering.

Concerning GLOW2.0 Virtual Planetarium development, even though the LJ was also intended for remote testing of the almost ready version of GLOW2.0 developed Virtual Planetarium (VP), this failed. Karelia faced problems with linking remotely the VP. The assumption is that the security levels and server specs could have been the reasons behind difficulties faced with trying to remotely run the application during the Learning Journey in Finland. This was however a great learning on ways to ascertain the full functionality to run the GLOW2.0 developed VP content "immersive experience".

Post learning journey, programming and content development work was performed, as well as testing of content in different applications. All 4 locations (Finland, Ireland, Iceland and Norway) were established and added together in the same application as they had been developed separately. Menu for selecting locations was added. The issues with the compiler have been resolved, as Microsoft has provided an updated version. The compiler is a core component that is used for building applications, and the game engine is using this for packaging projects. However, after the application was built some of the features were behaving differently than expected. The list of technical specifications (project deliverable D2.1.2) was substantially revised and appended with recommendations for SMEs and partners that want to implement the Virtual Planetarium (VP) into their portfolio. The VP application was finalized in the end of Period 5, and together with the short manual and an offline version will be uploaded and shared with partners.

Conclusion

The aim of GLOW2.0 Learning Journey activities was to map the adoption of relevant technology solutions in each region and report on those. Before the implementation of Learning Journeys, tourism products and services associated with values and benefits from dark sky and darkness of nature such as star gazing, night photography, and northern lights watching were known to majority respondents, with over 90% seeing potential in marketing these and other darkness related products and services. In addition, advanced digital solutions e.g. mobile apps, virtual reality applications, were considered added value to tourism, since utilising those could encourage visitors to explore more of what the region has to offer, help increase visitor numbers and empower tourism to become competitive. Technologies were also to some extent considered useful, as these could encourage visitors to stay longer at destinations.

However, lack of financial resources, lack of interest or understanding by destination management organisations, and limited knowledge about potentials were considered barriers to utilising values and benefits possibilities from darkness for tourism. Technologies that could be used to deliver night sky-type experiences were also not known to most respondents, with 56% of these not knowledgeable about digital solutions. Despite the setbacks, over 90% of respondents stated interest in learning how to use values and benefits from darkness as added value to current service offers, with almost 80 percent also wanting to learn about immersive technologies possibilities for business.

GLOW2.0 project consortium therefore aimed to enhance participants capacity in dark sky tourism development possibilities, with an emphasis on technological solutions. The aims were that at the end of a learning journey, stakeholders/ target groups would:

- learn about technology solutions that could support the marketing or delivery of their product/service to the Dark Sky's tourism economy.
- learn from other regions developments in this field; gain new ideas and take own old ones forward.
- bring them together to share experiences, learn from each other and building networks.

The learning Journeys offered participants learnings from the varied business models presentations, encounters and engagements with other SMEs, and introductions to the various technologies, including testing of the GLOW2.0 Virtual Planetarium. From participants feedbacks, the events offered new insights and helped take old ideas forward. For example, Ireland learning journey inspired one SME from Finland to move own dark sky activities forward, while various Iceland learning journey participants from Ireland were inspired by immersive experiences such as 1238 museum and FlyOver Iceland as a great concept that could be replicated and enhance visitors' accessibility. The GLOW2.0 virtual demo also inspired a Finnish SME offering guided tours in Lapland about possibilities of immersive technologies for expanding own activities, while the learning journey to Finland inspired an Icelandic accommodation provider about ways she could develop own offering. Examples of feedback:

"I really enjoyed the VR experience in the 1238 museum and could see this application used as an accessible way for all visitors to explore a clear night sky, it could be as interactive or sedentary as needed for different visitors. I also really enjoyed the Fly over Iceland experience and wonder whether a similar experience could be used in the planetarium. I think this is a great way to showcase the whole country/region and give visitors a taste of what is on offer, a good way to whet the appetite and hopefully keep them there for a bit longer or encourage them to come back."

"Would like to replicate "Fly over Reykjavik""

"Dark tourism' was a new concept that I think could work in Ireland."

"We are on similar paths by embracing digitalisation in the tourism sector. We have richness of assets and skills to capitalise on the opportunities digitalisation presents."

"Mayo Park is in accordance with the general concept I am familiar with. It has required a considerable amount of determined work. The most interesting form of activity for me was the children's and school children's laboratory, the teaching space and the educational activities that take place there."

"It was great to experience how tourism operates in this climate and especially how you can use the natural surroundings to develop walks."

The other goal of GLOW2.0 learning Journeys was for project partners to map the adoption of relevant technology solution in each region, such that at the end of a learning journey, partners would:

- map learning in each region in the adoption of the relevant technology solution.
- test, get feedback and share new ideas for development of GLOW2.0 virtual planetarium.
- report upon learning journey for the relevant technology solutions.

Partners mapped learning in each region in the adoption of technological solutions. Examples of technologies covered during learning journeys were among other, immersive 360-degree solutions, digital planetarium, virtual planetarium, immersive storytelling using technologies, virtual tours, immersive sensory experiences, nighttime lighting technologies that limit light pollution, immersive walls, immersive exhibitions, and gamification for heritage preservation. GLOW2.0 Virtual planetarium was also tested during the learning journeys to map adoption possibilities.

Partners received feedback on technologies and their potential applications for the Dark Skies tourism economy. Testing of GLOW pilot planetarium development in phases helped curtail it for adaptation in various participating regions (project output 2.1). The mapping of other technologies offered a wealth of feedback and helped draft the Delivery Framework for Immersive Technology adoption in SMEs (D2.4.2), Delivery Framework for Service Design adoption in SME marketing and Innovation activities (D2.4.3), and in curtailing the GLOW2.0 self-study modules developed for SMEs reskilling and upskilling, including those not directly engaged via Learning Journeys.

FURTHER INFORMATION

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Link to project website: [NPA GLOW](#)

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