Solar Polygeneration Collector for Combined Heat, Power, Hydrogen Fuel and Wastewater Treatment

Exploitation & dissemination report

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Exploitation & dissemination report

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V1.0	30/06/2026	Final report

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Nomenclature

Acronym	Meaning
D&C	Dissemination and Communication
IEA SHC	International Energy Agency Solar Heating and Cooling
IP	Intellectual Property
KER	Key Exploitable Result
KPI	Key Performance Indicator
M	Month
MS	Milestone
D	Deliverable
R&D+i	Research, Development and Innovation
TRL	Technology Readiness Level
WP	Work Package

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Public Executive Summary

Decarbonising the industrial sector requires reliable, cost-effective, and sustainable sources of renewable energy. Solar technologies offer significant potential, yet no commercial solution currently exists that can simultaneously deliver heat, electricity, and green hydrogen from a single solar device while treating industrial wastewater. Closing this gap requires not only technological innovation but also effective knowledge sharing, stakeholder engagement, and deliberate exploitation planning, activities that are essential to ensure that research outcomes translate into real-world impact.

This document represents D6.4 on Exploitation and Dissemination Report (Intermediate Version) of the SPECTRUM project, covering the period from project start through Month (M) 21. SPECTRUM is a Horizon Europe project developing and validating a novel solar concentrating collector that harnesses the full solar spectrum to co-generate heat, electricity, and green hydrogen while performing photocatalytic industrial wastewater treatment.

The central challenge addressed by this deliverable is how to effectively communicate an early-stage technology, currently at Technology Readiness Level (TRL) 2–3, to a diverse audience spanning academia, solar energy sector, potential industrial end-users, and policymakers, at a project phase where prototype hardware is under development and definitive technical results are not yet available. A further challenge is to begin building the ecosystem of stakeholders and collaborators that will be needed to take SPECTRUM's results beyond the project's lifetime.

The main results reported in this intermediate version are: the establishment of a fully operational communication and dissemination infrastructure (project website, LinkedIn channel, newsletter, press releases, and branded promotional materials), the organisation of the first SPECTRUM Workshop co-hosted with IEA SHC TCP Task 72, the launch of the PolyGen Alliance, the SPECTRUM R&D+i Hub, as a flexible collaborative platform for hybrid solar integration, and a preliminary identification of potential Key Exploitable Results spanning photocatalysts, two prototype collector designs, spectral splitting technology, and the PolyGen Alliance platform itself.

The main conclusions at M21 are that all communication KPIs are on track, and that the dissemination strategy is effectively reaching its primary target audiences in the research and renewable energy innovation communities. The PolyGen Alliance represents the most strategically significant output of the first project phase in terms of long-term exploitation: it positions SPECTRUM as a convener and not merely a research project and lays the groundwork for continued knowledge exchange and potential follow-on funding beyond M42. The second phase of the project (M22–M42), driven by prototype testing and system-level results, will generate the technical substance needed to intensify outreach to industrial end-users and policymakers, and to develop a full exploitation plan.

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1. Introduction

1.1. Purpose and Objectives

Deliverable (D) 6.4 is produced as an intermediate version at Month 21. A final, comprehensive version will be delivered at M42. The purpose of this intermediate report is:

1. To document and assess the Dissemination and Communication (D&C) activities carried out from project start through M21, reporting progress against the KPIs established in the Communication and Dissemination Plan (D6.1).
2. To report on the establishment and early development of the PolyGen Alliance, the SPECTRUM Research, Development and Innovation (R&D+i) Hub, as a mechanism for sustained stakeholder engagement and knowledge transfer beyond the project.
3. To discuss a preliminary identification of potential Key Exploitable Results (KERs) and exploitation pathways, as a foundation for the full exploitation strategy to be developed in the second project phase.

This report consolidates activities carried out under the following WP6 tasks:

- Task 6.1: Development of the communication and dissemination strategy and plan.
- Task 6.3: Dissemination and communications actions.
- Task 6.4: Creation of the hybrid solar technologies European R&D+i Hub (PolyGen Alliance).
- Task 6.5: Dissemination and knowledge transfer to sectors other than energy.

Furthermore, this report builds on previously developed documents/deliverables: D6.1, D6.6, milestone (MS) 17, and MS18.

In terms of parallel project activities, it is noted that the availability of experimental results from WP3 and modelling results from WP4 will substantially enrich the dissemination activities and exploitation planning reported in the final version of D6.4 at Month 42.

1.2. Document Structure

The remainder of this report is organised as follows:

- Section 2 defines the D&C objectives.
- Section 3 describes the communication tools and channels established and maintained by the consortium.
- Section 4 documents main dissemination activities carried out during the reporting period (M1–M21).

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- Section 5 describes the PolyGen Alliance: its concept, launch, early outreach, and planned development.
- Section 6 provides a status and outlook of the exploitation.
- Section 7 reports progress against the KPIs defined in the Communication and Dissemination Plan.
- Section 8 presents conclusions and the outlook for the second project phase.

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2. Dissemination and Communication Objectives

The D&C activities of SPECTRUM serve two complementary purposes.

Dissemination aims to share the project's technical and scientific findings with peers, the research community, and relevant stakeholders, with the goal of facilitating the adoption, replication, and further development of SPECTRUM's results beyond the project consortium. Key channels include scientific publications, conference presentations, and expert workshops.

Communication aims to raise general awareness of the project, its goals, and its progress among a broader audience including industry actors, policymakers, and the general public. Key tools include the project website, social media, newsletters, press releases, and promotional materials.

The overarching D&C objectives, as defined in D6.1 and updated in D6.6, are:

- Promote SPECTRUM's results and benefits for external awareness creation and stakeholder engagement.
- Provide scientific and technical evidence of the benefits and scalability of the SPECTRUM technology.
- Reach industrial sectors with relevant heat, power, hydrogen, and clean water demand profiles as potential end-users.
- Establish the PolyGen Alliance as a lasting community platform for hybrid solar integration beyond the project lifetime.

The D&C Plan is governed by a set of Key Performance Indicators (KPIs) monitored regularly. Progress against KPIs is reported in Section 7 of this document.

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3. Communication Tools and Channels

The SPECTRUM communication infrastructure was established during the first phase of the project (M1–M6) and has been actively maintained and expanded since. The core tools and channels are described below.

3.1. Project Website

The official SPECTRUM project website (www.project-spectrum.eu) is the primary communication and dissemination channel. It provides a central access point for all project information, news, public deliverables, and event resources.

As of M21, the website has recorded 972 visitors with an average session duration of over 2 minutes, surpassing the Year 2 target of 200 visitors ahead of schedule.

3.2. LinkedIn

The SPECTRUM LinkedIn page (linkedin.com/company/project-spectrum-eu) is the primary social media channel, used to publish project updates, event announcements, deliverable releases, and engagement with the research and renewable energy communities.

Activity has consistently exceeded the target of at least one post per month. As of M21, the page has reached 389 followers. Audience analysis confirms strong engagement from the higher education sector (17.5% of followers), research services (8.5%), and renewable energy services (6.9%), confirming effective reach of the primary target audiences. Engagement from industrial manufacturing sectors is gradually growing.

3.3. Newsletter

The SPECTRUM newsletter provides periodic updates on project activities, scientific progress, and upcoming events to a subscribed audience. The first issue was published in June 2025 and reached 71 subscribers through mailing lists and is also available on the project website (https://project-spectrum.eu/newsletter/). A second issue is planned for the second half of 2026, timed to coincide with the external promotion and launching of the PolyGen Alliance.

3.4. Press Releases

Two press releases have been published to date, distributed through partner networks and published on the project website. Press releases have addressed the project launch and the first SPECTRUM workshop. Given the early-stage TRL nature of the project, the availability of press-ready results is limited in the first phase; a higher volume of press releases is anticipated from Month 24 onwards as prototype results become available.

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3.5. Promotional Materials

A full set of branded promotional materials was developed following the visual identity guidelines established at project launch:

- Project poster
- Roll-up banner
- Project brochure

These materials are available in digital format on the project website and are to be distributed at conferences and events when possible. Partners are encouraged to adapt them for national audiences. Materials are produced in the SPECTRUM brand/visual identity.

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4. Dissemination Activities (M1–M21)

This section documents the main dissemination activities carried out from the start of the project through M21. Activities are presented chronologically and grouped by type.

4.1. SPECTRUM's Workshops: First SPECTRUM Workshop (MS18)

The first SPECTRUM workshop, titled "Materials for Solar Photochemistry Applications", was organised jointly by SPECTRUM and IEA SHC TCP Task 72 (Solar Photoreactors for the Production of Fuels and Chemicals). The event took place on 9 October 2025 at LNEG facilities in Lisbon, Portugal, in a hybrid format.

The workshop attracted 38 participants from across Europe and beyond, representing universities, research institutes, and industry stakeholders including LNEG, MG Sustainable Engineering, AEE INTEC, DLR, IMDEA Energy, TU Wien, DTU, University of Bologna, University of Gdansk, Kingston University, Stellenbosch University, and Instituto Superior Técnico.

The scientific programme included sessions on:

- Sacrificial agents for fuels and chemical production (industrial wastewater as a resource).
- Development and testing of novel photocatalysts.
- Photoreactor design and testing.
- A technical visit to LNEG laboratories.

The event was actively promoted through the SPECTRUM LinkedIn page (six promotional posts and a LinkedIn event page) and the recording was made publicly available on the project website. The workshop strengthened connections with the international solar photochemistry community and generated positive feedback for continued collaboration.

4.2. Participation in International Events and Conferences

As of Month 21, the SPECTRUM consortium has been represented at eight external events and conferences. Details of specific events are tracked in the WP6 D&C activities reporting tool while the highlights are listed below.

4.2.1. EuroSun 2026

The EuroSun 2026 Conference is a major international conference on solar energy organised by ISES Europe. SPECTRUM has been accepted for an oral presentation to present a conference paper on the optical analysis and performance evaluation of a novel solar polygeneration collector capable of simultaneous electricity, heat, hydrogen generation, and photocatalytic wastewater treatment for sustainable industrial

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applications. Additionally, a poster presentation on the PolyGen Alliance has been accepted and the alliance has been invited to be part of a side event for similar initiatives during the conference. This represents an important step in disseminating early SPECTRUM research to the broader solar energy community and will provide an opportunity to promote the PolyGen Alliance to a wider European audience. Further details on the EuroSun contribution will be documented in the D6.4 final version at M42.

4.2.2. IEA SHC Task 72 Expert Meetings

The SPECTRUM Project and the PolyGen Alliance were also presented at all four of the IEA SHC Task 72 expert meetings, further strengthening the alignment between SPECTRUM and the international IEA Solar Heating and Cooling programme. This engagement supports the long-term ambition of the PolyGen Alliance to connect with established international expert communities working on solar photochemistry and hybrid solar technologies. The news of the collaboration has also been published in National Laboratory for Energy and Geology (LNEG)'s news: https://www.lneg.pt/lneg-participou-na-task-72-da-aie-com-apresentacao-de-avancos-do-projeto-spectrum/

4.2.3. 100% RHC Conference 2025

Hosted by the European Technology and Innovation Platform on Renewable Heating and Cooling, this premier conference convened stakeholders from renewable heating and cooling sectors, along with platform members and beyond. This event featured a blend of policy and technical sessions, with contributions from European Commission representatives, industry associations, technical experts, and others. During the event, SPECTRUM had a poster presentation to boost visibility of the project.

4.3. External Media Collaboration

The SPECTRUM Project has also gained interest and exposure through some international relevant solar initiatives as listed below.

4.3.1. IEA SHC Programme Solar Update Newsletter

The PolyGen Alliance was featured in the IEA SHC programme Solar Update newsletter following the launch of its first meeting in March 2026. This external recognition significantly extended the reach of the initiative beyond the SPECTRUM consortium and consortium networks and has contributed to growing interest from the international solar heating and cooling research community.

(https://iea-shc.us3.list-manage.com/track/click?u=5bec682a2cbca5424f1d85cd4&id=2729ceab04&e=5095ae895b)

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4.3.2. SolarThermalWorld

A Solarthermalworld article was published highlighting the SPECTRUM project and its work on developing hybrid solar collectors that go beyond single-output energy systems(https://solarthermalworld.org/news/hybrid-solar-collector-unlocks-triple-solar-energy-harvesting/).

4.4. Scientific Publications

Two peer-reviewed journal articles have been published by SPECTRUM consortium members during the reporting period, both directly relevant to the collector design and optical-electrical modelling work underlying the project:

Publication 1: Markides, C.N. *et al.* (2025). "Numerical study of a parabolic-trough CPV-T collector with spectral-splitting liquid filters". *Frontiers in Energy*, 19(6), pp. 949–968. https://doi.org/10.1007/s11708-025-1028-y

This paper presents a coupled optical-electrical-thermal CFD model of a parabolic-trough concentrating photovoltaic-thermal (CPV-T) collector using liquid spectral-splitting filters (water, $AgSiO_2$-EG, and Therminol-66), directly addressing the spectral splitting approach at the heart of the SPECTRUM-HT collector concept. The study was led by Imperial College London.

Publication 2: Acosta-Pazmiño, I.P. *et al.* (2025). "On the Influence of PV Cell and Diode Configurations on the Performance of a CPVT Collector: A Comparative Analysis". *Energies*, 18(13), 3479. https://doi.org/10.3390/en18133479

This paper reports ray-tracing simulations (using Tonatiuh) to optimise the PV cell and diode configurations of the Double MaReCo (DM) concentrating PV-T collector – the collector architecture underlying the SPECTRUM-LT prototype developed by Solarus Renewables and Högskolan i Gävle. The study quantifies the influence of gable transparency and cell layout on annual irradiance and electrical output.

Both publications are open access and available via the respective journal websites. Scientific publications are tracked in the WP6 publications reporting tool, and all outputs are being deposited in the SPECTRUM Zenodo community (zenodo.org/communities/spectrum-project) in line with Horizon Europe open science requirements. Further publications are anticipated from M22 onwards as more data become available.

4.5. Open Access Repository - SPECTRUM Community on Zenodo

The SPECTRUM project maintains a dedicated community on Zenodo, the open research repository operated by CERN and co-funded by the European Commission, accessible at: https://zenodo.org/communities/spectrum-project.

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The community serves as the project's open-access repository for all publicly shareable research outputs, including scientific publications, datasets, reports, and other materials generated throughout the project. It is part of the EU Open Research Repository, the European Commission's designated open science infrastructure for Horizon Europe-funded projects and is directly linked to the SPECTRUM project website (www.project-spectrum.eu).

All public project deliverables and scientific outputs are progressively deposited in the SPECTRUM Zenodo community, in line with the open science obligations set out in the SPECTRUM Grant Agreement and the Horizon Europe Programme. Depositing outputs in Zenodo ensures that results are findable, accessible, interoperable, and reusable (FAIR principles), and provides persistent digital identifiers (DOIs) for all uploaded records, facilitating citation and long-term discoverability.

Partners are encouraged to deposit publications, datasets, and other shareable outputs in the SPECTRUM Zenodo community as soon as they become available, coordinating with the WP6 lead (MG) to ensure consistent data, appropriate access rights, and alignment with any requirements by journal publishers.

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5. The PolyGen Alliance - SPECTRUM R&D+i Hub (T6.4)

The establishment of the SPECTRUM R&D+i Hub was a key WP6 activity foreseen from the project's start. The Hub, formally named the Polygenerating Solar Collector's Alliance (PolyGen Alliance), was designed as a collaborative and flexible platform to connect research, industry, and innovation stakeholders working on hybrid solar energy systems.

5.1. Hub Concept and Scope

The PolyGen Alliance focuses on collector-level integration challenges rather than isolated component development. Its scope encompasses:

- Hybrid solar technologies and system architectures.
- Solar-to-hydrogen and solar-to-chemical pathways.
- Solar industrial heat applications.
- Integration with water and wastewater treatment systems.
- Environmental and economic assessment approaches.
- Modelling, simulation, experimental validation, and standardisation.

A core principle agreed at launch is that the Alliance should remain lightweight and flexible, avoiding complex governance structures while enabling meaningful collaboration and knowledge exchange.

5.2. First Hub Meeting - PolyGen Alliance Launch (MS17)

The first PolyGen Alliance meeting was held on 27 March 2026 in an online format, with active participation of all SPECTRUM project partners.

The meeting achieved the following:

- Formal launch of the SPECTRUM R&D+i Hub.
- Agreement on the final name: Polygenerating Solar Collector's Alliance (PolyGen Alliance).
- Alignment on the Hub's scope, purpose, and flexible operational approach.
- Definition of a lean and targeted communication strategy.
- Identification of priority thematic areas and external stakeholders for early engagement.
- Agreement on next steps including engagement with IEA SHC Task 72 and participation in EuroSun 2026.

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5.3. External Visibility and Outreach

Following its launch, the PolyGen Alliance has gained early external visibility:

- Featured in the IEA SHC programme Solar Update newsletter, reaching the international solar heating and cooling research community.
- Accepted for presentation at EuroSun 2026, providing a platform to recruit new members from the European solar energy research community.
- Presented at the IEA SHC Task 72 expert meeting, strengthening the connection with this international initiative.

A dedicated section for the PolyGen Alliance has been created on the SPECTRUM project website (www.project-spectrum.eu/polygen-alliance), where interested stakeholders can learn about the initiative and register their interest in joining.

5.4. Next Steps for the PolyGen Alliance

In the next phase of the project (M22–M42), the main planned activities for the PolyGen Alliance include:

- Broadening the external membership base through targeted outreach to industry actors, solar technology manufacturers, and relevant research networks.
- Organizing a second Hub meeting and at least one annual meeting aligned with key project milestones.
- Increasing the visibility of the Alliance through joint publications, conference contributions, and integration with the SPECTRUM newsletter.
- Defining and publishing a roadmap or position paper for hybrid solar integration, reflecting the collective knowledge of Alliance members.

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6. Exploitation - Status and outlook

At M21, the SPECTRUM project is in the early stages of its prototype development phase (WP3 commenced at M18). The identification and formalisation of KERs require a sufficient level of technical maturity that is not yet available at this project stage. SPECTRUM is a Research and Innovation Action with expected TRL 4 at project end; exploitation pathways will only be determinable once prototype performance data, system integration assessments (WP4), and lifecycle sustainability analyses (WP5) are available.

For these reasons, a full exploitation section, including KER identification, partner-specific exploitation plans, IP status, and business model analysis, is deferred to the final version of D6.4 at M42, by which point the project will have completed prototype fabrication and testing, and will have a substantively clearer picture of which results are ready for further development, licensing, or follow-on research.

In the interim, exploitation-related activities within the consortium are focused on: maintaining awareness among partners of their obligations under the Grant Agreement and Consortium Agreement with respect to IP management and result ownership; ensuring that any potentially patentable findings are flagged to the project coordinator in advance of publication; and monitoring relevant market and policy developments in the solar energy, green hydrogen, and industrial decarbonisation sectors that may inform exploitation planning in the second project phase.

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7. D&C Monitoring and KPIs

The SPECTRUM D&C Plan is regularly monitored and updated to ensure the project remains on track to achieve its outreach objectives. A set of KPIs has been established to measure the effectiveness of D&C activities. The table below reports the current status of each KPI at Month 21.

Table 1 SPECTRUM KPIs reporting

Activity	KPI / Target	Status (M21)
SPECTRUM Website	>200 visitors year 2 >400 year 3 >1000 by M42. Avg session >2 min	972 visitors Average session >2m
LinkedIn	>1 post/month >200 followers by year 2 >400 by year 3	>1 post/month 389 followers
Newsletters	>2/year	1 issue (June 2025) 71 subscribers
Press Releases	>2/year	2 published
Events / Conferences	500 hardcopy leaflets distributed Representation at events	8 events / conference participation. Materials created
Workshops	3 project workshops	1 workshop (Oct 2025), 38 participants
PolyGen Alliance	R&D+i Hub kick-off before project completion	Launched 27 Mar 2026

KPI monitoring is conducted using two shared tools maintained by MG on the project Teams channel: the D&C Activities Reporting Tool (tracking all communication and dissemination activities by partners) and the Publications Reporting Tool (tracking all scientific outputs). All partners are encouraged to update these tools regularly.

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A social media content calendar has been developed to ensure consistent and well-distributed content generation across all consortium partners. Each partner is assigned specific months for content contribution, ensuring regular posting frequency and a diversity of perspectives throughout the project timeline.

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8. Conclusion

At M21, the SPECTRUM project has successfully completed its first phase of D&C activities and has established a solid foundation for the second phase, which will be driven by upcoming growing volumes of technical and scientific results.

Key achievements to date include:

- A fully operational communication infrastructure: project website, LinkedIn page, newsletter, press releases, and promotional materials.
- Eight appearances at international events and conferences.
- Organization of the first SPECTRUM Workshop.
- Launch of the PolyGen Alliance with growing external visibility.
- All main communication KPIs on track or achieved ahead of schedule.

Looking ahead to M21–42, the main priorities for WP6 are:

- Intensifying dissemination efforts as prototype test results (WP3) and system-level simulation outputs (WP4) become available.
- Increasing engagement with industry actors and policymakers as the project moves toward higher TRL results.
- Growing the PolyGen Alliance membership and organizing further Hub meetings.
- Supporting the preparation and publication of peer-reviewed scientific outputs.
- Developing the full exploitation strategy and finalizing KER identification ahead of the M42 final report.

This intermediate version of D6.4 will be updated and expanded in the final version at M42, which will include a comprehensive exploitation plan, a full account of all dissemination activities, and a final KPI assessment.

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