

ASSIGNMENT DESCRIPTION

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1. Introduction

Introduction project Einstein Telescope

The objective of the Einstein Telescope is to build a large-scale research infrastructure that will be the next generation gravitational wave detector for further scientific research of the cosmos. The Einstein Telescope is adopted in the 2021 European roadmap for research Infrastructures (ESFRI). This confirms the excellent science case and the plans to construct the Einstein Telescope in Europe, including the site selection.

The starting conditions of the Euregio Meuse-Rhine to host the Einstein Telescope are favourable. The unique soil allows for dampening vibrations and building the research infrastructure in a relatively quiet landscape. The multimodal infrastructure and international living and business climate are attractive for the scientific community. This region offers strong research institutes, high-tech industry and educational institutes to drive the innovation and skills development; they already work together at the ETpathfinder, ET-CRISTAL and ETEC facilities. Belgium, Germany and North Rhine-Westphalia work together and are open to other countries joining their ambition to host the Einstein Telescope. This is the foundation for a solid ET-EMR Bidbook and Consortium.

The Einstein Telescope offers the Euregio Meuse-Rhine (EMR) an unique opportunity to take a global leadership position in a new pioneering area of science: gravitational wave research. Housing the Einstein Telescope in this region will boost a positive impact on science, economy and society. A solid impact and business case feasibility study will provide an important foundation for the EMR Bidbook and Consortium proposals. A common vision of the EMR on the impact potential and solid plans to reach this potential are of highest priority and urgency.

Note; Already various impact studies have been performed in a one-national context; these deliver sufficient input and a good starting point on the overall potential. The step now is to deliver a feasibility study in a three-country context, with a clear plan and conditions to deliver the impact within the project-scope (including the measures to effect, total costs and risk management).

For more info see www.einsteintelelescope-emr.eu.

Project office ET

At the ET Ministerial Conference 26 September 2023 in Brussels, delegates from Belgium, the Netherlands and the German Federal State of North Rhine-Westphalia agreed to prepare a bidbook and joint consortium to establish the Einstein Telescope in the Euregio Meuse-Rhine. The ET-EMR Project Office is tasked by the Ministerial agreement (DoI, 26 September 2023) to deliver the feasibility studies to realise the Einstein Telescope in the Euregio Meuse-Rhine. On 30 May 2024 the EMR ministers signed an addendum to the DoI. This addendum delegates the preparations of the bidbook to the Project Office. The ET-EMR Taskforce supervises the work of the Project Office.

2. Assignment

The preparations of the bidbook include work package 3 (BB-WP 3; economic case); this includes two feasibility studies that are closely related, both in process and output;

- Impact Case feasibility study report; execution 2025 Q2 – 2025 Q3 (draft report);
- Business Case feasibility study report; execution 2025 Q4 – 2026 Q1 (draft report);
- Finalizing the reports; execution 2026 Q4 (final report).

The work is further described in Chapter 3.

Chapter 5 contains the Annexes.

3. Work

3.1. General

The bidder must provide a list of subcontractors (in so far as this is the case).

3.2. Communications

3.2.1. Client – Contractor

Client and contractor will both appoint a senior Product / Project Manager who will be in charge of the day-to-day management and will be the first point of contact for all operational matters.

The Client shall also appoint a Contract Manager. Adjustments or changes with financial implications, can only be made after written approval by both project managers and the Contract Manager.

3.2.2. Communication with the environment

- The client is responsible for external communication. Any questions from press or members of the public have to be passed on to the Product Manager.
- Publication are allowed only after explicit review and permission from the Client.

3.3. Impact Case feasibility study

Central question: *What valorisation, return and long-term impact is feasible when establishing the Einstein Telescope in the Meuse-Rhine Euroregion? What are the options and conditions?*

Starting point is the anticipated realisation of a full scope (triangle) Einstein Telescope in the Euregion Meuse-Rhine. The design, budget (costs and funding), governance and timeline are under discussion. There is already much information available with regard to the scope and impact potential as input.

The economic study will support political decision making; it is not to anticipate on these decisions beforehand. The study will also support the decision making on a European level with regard to the focus of housing the ET as a single sited facility in the EMR. And the study has to demonstrate a solid case for Europe and the benefits for other European countries to decide for the EMR and European best practices discussed. The EMR Steering Group also requests to organise an exchange of knowledge and experiences at other facilities and best practices.

The Impact Case feasibility study report is to adress the following:

1. Impact potential of the Einstein Telescope (3 x 3 boxes);
 - a. In three phases; preparatory phase, construction phase and operational phase;
 - b. In three dimensions; direct effects (infra&science), spinoff effects and ecosystem effects;
2. Impact potential for the ET-EMR Consortium countries (Belgium, Germany and the Netherlands);
 - a. Regarding the location boundness of economic activities;
 - b. Regarding the innovation potential and competitiveness of the ET-EMR Consortium countries (Belgium, Germany and the Netherlands) and their ecosystem;
 - c. Regarding the possibilities of (procurement) regulations.
3. Description of the economic impact model in terms of:
 - a. Impact pathways, impact drivers and scenario's;
 - b. Input, throughput, output and outcome model including a sensitivity and risk analysis;
 - c. Quantitative and qualitative ratio's of the economic cost and impact model;
4. Plan for impact optimisation for the ET-EMR Consortium countries;
 - a. Options for scientific institutes, industry and other partners;
 - b. Options inside the current infrastructure scope and budget and additional options;

- c. Required governmental support and conditions;
 - d. Strategic options and no regret options.
- 5. Management summary with an answer to the following questions:
 - a. What is the investment, return and valorisation impact potential of the preparatory phase? What are strategic and no regret investment options until the moment of site decision?
 - b. What is the direct return potential of the construction and operation of the Einstein Telescope? What are the options and their trade-off effects (science case; infra case; economic case) to optimize return?
 - c. What is the anticipated long-term and wider socioeconomic impact potential of operating the Einstein Telescope? What would be the conditions and (additional) facilities needed to optimally harvest the anticipated economic effects?
 - d. What are the options/ scenario's to balance the return/impact and break even with the costs, from the perspective of the ET-EMR Consortium countries (Belgium, Germany and the Netherlands) and other European countries interested in funding the Einstein Telescope? And how to translate this in the business case strategy.

3.4. Business Case feasibility study

The Business Case feasibility study is to address the following:

1. ET-EMR Bidbook BC scoping; science case, infrastructure case and impact case;
Note; the three cases could introduce additional facilities into the scope that are currently not in the science case scope (for instance facilities for education, valorisation and outreach).
2. Total budget; costs, risk and funding plan;
3. Costing and cash flow schedule (life cycle);
 - o preparatory phase;
 - o construction phase;
 - o operational phase;
 - o deconstruction phase;
4. Funding;
 - o Host countries funding;
 - o Required funding other countries;
 - o Timing of required commitments and funding;
5. Conditioning of the business case;
 - o Financial management;
 - o Financial risk management;
 - o Contracting strategy;
 - o Legal management and governance.

Note;

- The quality of the business case study should be to the standards of German, Belgian, Dutch and European standards to provide a credit when deciding on the EMR bidbook and site candidature.
- We expect the business case to deliver a plan for the tendering/ contracting and legal organisation to optimally distribute and manage the costs, risks and impact for the ET-EMR Consortium. This should be based on a market analysis and options for contracting and legal organisation modelling.

4. Planning

- Impact Case feasibility study report; execution 2025 Q2 – 2025 Q3 (draft report);
- Business Case feasibility study report; execution 2025 Q4 – 2026 Q1 (draft report);
- Finalizing the reports; execution 2026 Q4 (final report).

Note; The business case study should (next to the outcome of the impact study) also include the plans and conditions to optimally exploit the science case (work package 1) and sustainably integrate the infrastructure (work package 2) in the EMR. It has to be considered that a solid and final business case first needs serious attention in de-risking the infrastructures engineering and costs. Cost estimates and a financial plan for the infrastructure are to be expected by the end of 2026. The final costs will also determine the absolute numbers of return. Therefore both studies are expected to be finalized by 2026 Q4.

5. Annexes; anticipated ET-EMR Impact case framework

Following framework shows the ET project phases, impact aspects that require attention in the impact studies and planning and strategic questions:

	Preparatory phase/ detector R&D 2025-2035; preparing detector 1.0 & 2035-2085; upgrades development Note; direct impact and no regret; site feasibility studies are excluded (incidental; low cost/return; regret)	Construction phase 2028-2035; integral infra construction 2035-2085; upgrades installation Note; included are civil engineering, vacuum systems and detector	Operational phase 2035-2085; operation of infra and facilities Note; included are all operational facilities for the Einstein Telescope
First order effects (direct): - Production of goods - Delivery of services - Direct employment	<i>Direct return of costs potential;</i> - Location boundness; - Competitive advantages; - Procurement regulations;	<i>Direct return of costs potential;</i> - Location boundness; - Competitive advantages; - Procurement regulations; What is the direct return case?	<i>Direct return of costs potential;</i> - Location boundness; - Competitive advantages; - Procurement regulations; What is the direct return case?
Spillover effects (structural): - Spinoffs and new products - Increased human capital - Higher added value	<i>Hi-tech valorisation development;</i> <i>Hi-tech business development;</i> Wat is the hi-tech valorisation case? Potential of existing and new facilities?	<i>Construction valorisation development;</i> <i>Construction business development;</i> Are there spillover effects in construction?	<i>Science valorisation development;</i> <i>Science business development;</i> Are there spillover effects in operation?
Ecosystem effects (structural): - Hi-tech & innovation clusters - Increased productivity - Talent/ skills development	<i>Hi-tech talent and skills development;</i> <i>Hi-tech ecosystem development;</i> What is the impact on the research and innovation ecosystems?	<i>Construction ecosystem development;</i> <i>Construction outreach facilities;</i> Are there ecosystem effects in execution?	<i>Science talent and skills development;</i> <i>Science ecosystem development;</i> <i>Settling of scientsts and added value;</i> <i>STEM and outreach facilities and programs;</i> <i>EMR network and branding effects.</i> Scientists (4000) settling in EMR potential? What are the 'crown jewels' for the EMR?