

OVERVIEW OF THE FCC SOCIO-ECONOMIC IMPACTS

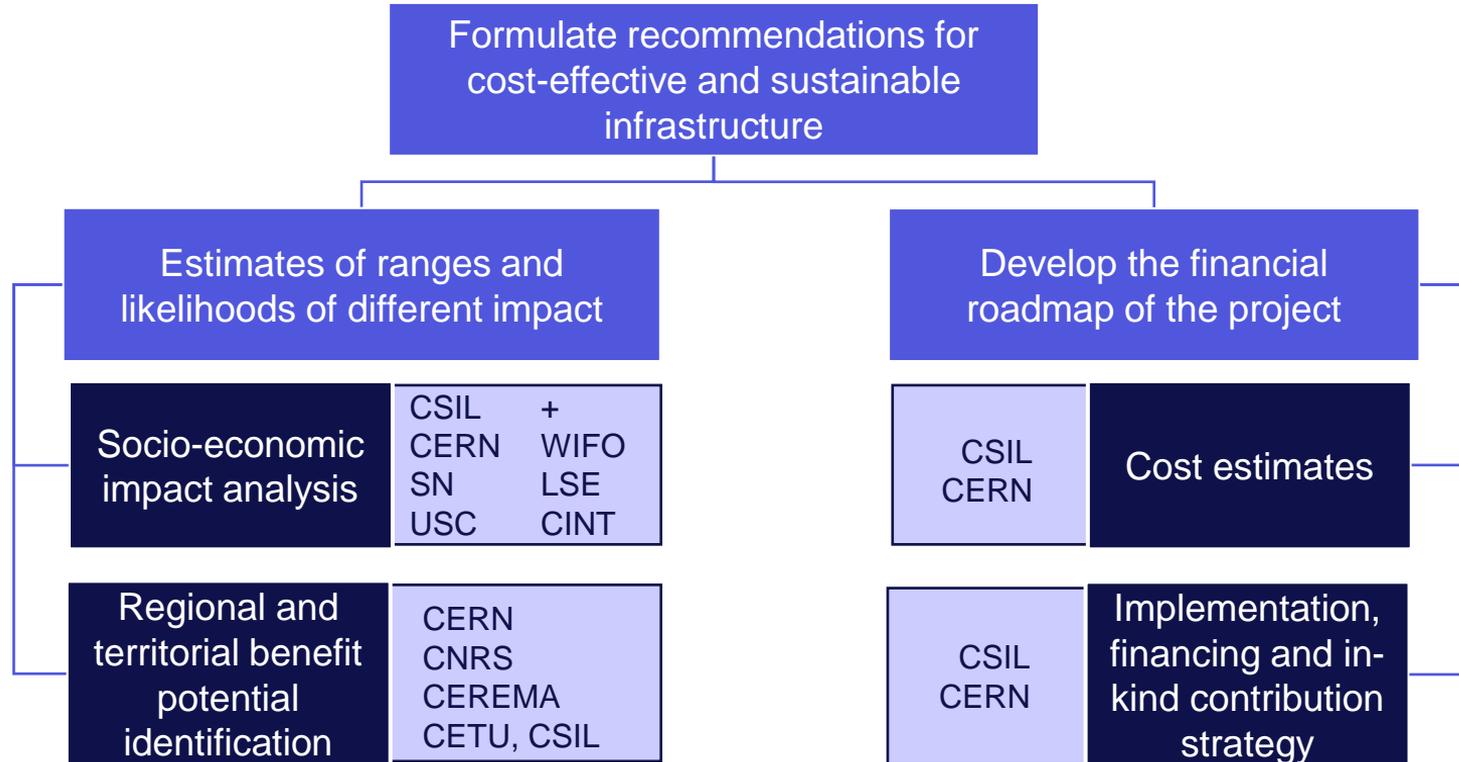
6 June 2023

FCC Week 2023

Millennium Gloucester Hotel London Kensington



Objectives and team



Socio-economic impact analysis

MAIN IMPACT PATHWAYS

Scientific
production

Training

Industry
benefits

Cultural
benefits

Data and
ICT

Environment
al benefits

Overall approach

- Long-time perspective, covering the entire life time of the FCC-ee
- Quantification of the minimum likely expected socio-economic return
- Probabilistic model, building on historical data and expert opinions
- Distinction between:
 - global and territorial impacts
 - directly caused and wider benefits

The true socioeconomic impact of FCC can be larger than the one captured by the quantitative model

Known Knowns

We measure the impact pathways, plan and forecast them for RI scenarios.

Known Unknowns

We know the impact pathways exist, but we do not know how to measure them.

Unknown Knowns

We have insufficient time, people, money to measure, analyse and plan for the impacts.

Unknown Unknowns

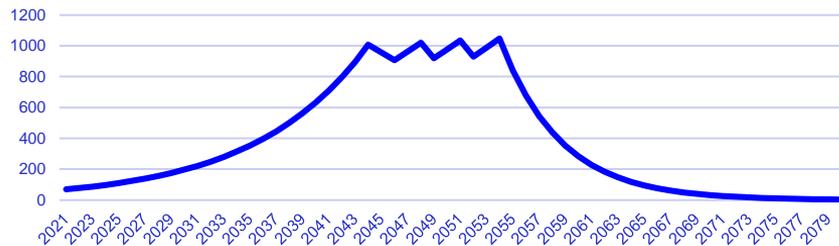
Impact pathways we are neither aware of nor understand.

Scientific production

Method

- **Scientific products:** Articles in peer-reviewed journals; Working papers/not peer-reviewed articles in document servers, notes, reports, PhD theses; Pre-prints; Conference proceedings; Books for academic use; Chapters in edited books.
- **Number of FCC scientific products** estimated based on historical curve of LHC, LEP and Tevatron.
- Economic value proxied by the **production opportunity cost of FCC-ee related scientific products, and their citations over time:** the scientist's annual gross salary divided by the number of hours worked can be taken as a proxy of the value for society of his/her time.

Estimated number of P0 FCC-ee scientific products (FCC-ee time horizon 2021-2057)

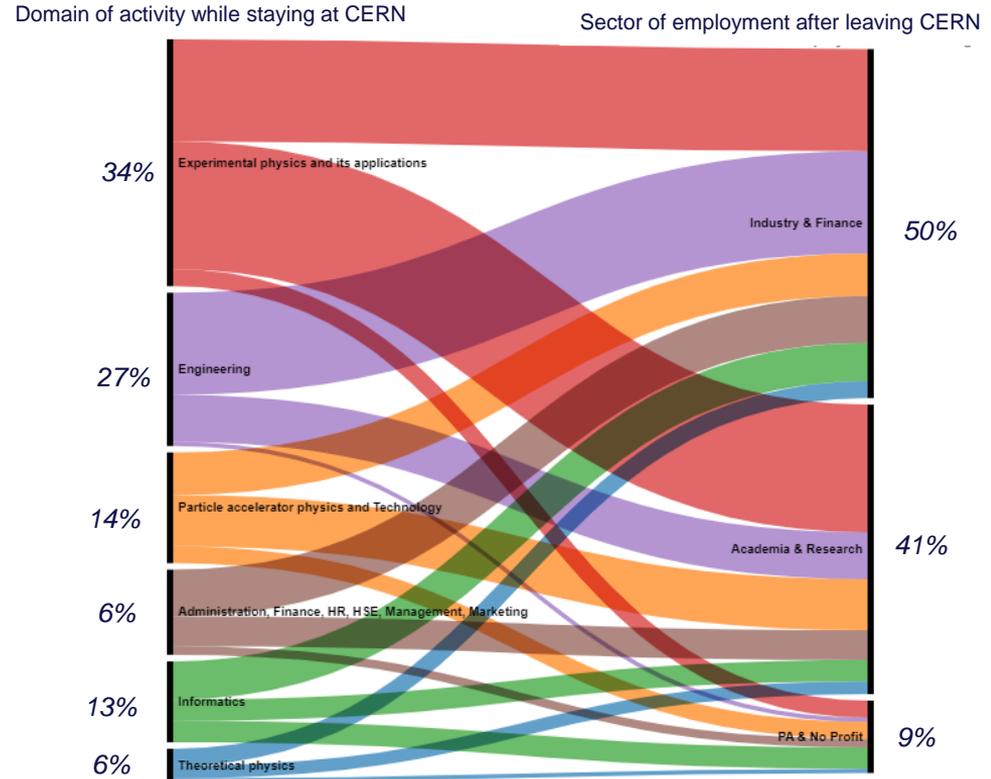


Flows of scientific production	Estimated number
FCC-ee scientific products (P0)	20 thousand (2021-2057)
Scientific products citing P0 products (P1)	55 thousand (2021-2080)
Scientific products citing P1 products (P2)	220 thousand (2023-2080)

The value of training

Method

- **Beneficiaries:** PhD students, post docs, technical students, young fellows that spent a period of job at CERN
- The benefit is estimated as the **incremental salary premium** they gain as compared to their peers (without such job experience)
- **On-line survey** to former researchers at CERN, now in the labour market: about 400 valid responses
- **Econometric analysis** to estimate the impact of CERN on salary:
 - salary premium = 3% (2-4%) for each year spent at CERN
 - salary premium = 6% (2-10%) for the average duration of stay at CERN (3.8 years)



Industrial impacts

Approach 1 (CSIL)

- **Spillover effects for supplier companies** due to innovation, learning and reputation gains
- Procurement cost and degree of innovativeness (high-tech and low-tech)
- **Profit/sales multiplier for CERN suppliers** based on past surveys and analysis of balance sheets data: **3.11 for high-tech procurement**

Approach 2 (WIFO)

- **Direct, Indirect and wider effects on value added** due to the investment and operation expenditure of FCC
- Effects computed on the basis of a macroeconomic model for all European countries (**input/output tables**)

Approach 3 (LSE)

- **Indirect territorial effects on employment** of FCC procurement on one illustrative firm
- How far the employment benefits diffuse to other sectors and outside the company (municipality and region)?
- Counterfactual evaluation to estimate the **net causal** effect (synthetic control group)

ICT and data spillovers

Virtual repository (Zenodo)

- **Data storage** benefit: value estimated based on market price of a similar tool (Dryad)
- **Online usage**: monetary value of the time spent by unique visitors on the repository website
- **Downloads**: monetary value of the time spent by unique visitors

Web collaborative service (Indico)

- Price for a “**synthetic Indico-like system**” based on prices of alternative systems covering all Indico functionalities
- **Hypothetical Willingness to Pay**, estimated with an **on-line survey** to Indico users (private sector companies with more than 50 computers using Indico for conference, workshop, and meeting management): 2100 respondents

ICT spinoffs

- **Number of companies** created by people who leave CERN or CERN employees
- Estimation of the **economic value** produced by these companies over their lifetime

An improved detector simulation software (GEANT)

- Estimation of the **users community** outside CERN (physics, astronomy, medicine, finance, ...)
- Benefit: estimated **avoided cost** by the external users

Cultural effects

Onsite visitors

- Estimated **number of visitors**
- Socio-economic value: **travel cost + value of travel time + on-site expenditure**
- Results based on a **survey** launched in 2018-2019 collecting information from 892 visitors
- **Total expenditure per visitor** (in group or individual): 550-640 CHF (4-day visit on average)
- Around 50%: benefit from visitors for the local territories

Online visitors

- Estimated number of visitors of CERN-managed social media and websites
- Socio-economic value: **value of time** spent in viewing and interacting



Three examples of positive environmental impacts

Production of electricity from renewable sources and overcapacities

- Sourcing from renewable energy sources can lead to the **replacement of fossil energy sources, and** contribute to the energy transition in Europe, thus reducing **greenhouse gases and environmental impacts**
- **Construction and operating FCC-ee with renewable energy** sources via long-term procured resources can be both **economically attractive** and permit, due to allocation of overcapacities, **making available electricity for other institutional/societal consumers** at attractive prices.

Waste heat recovery and supply

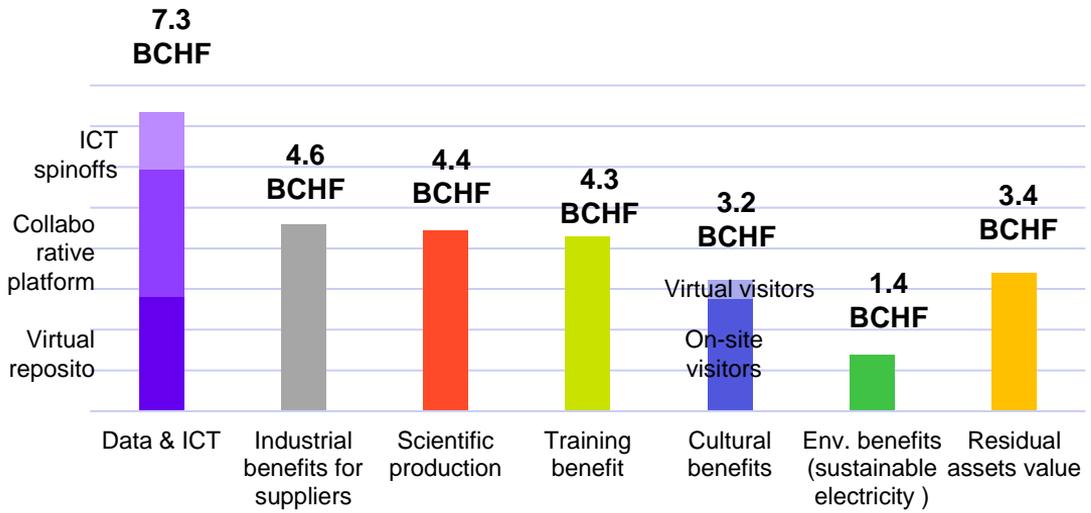
- Conservative low-end estimate of 20 GWh of low-grade waste heat recovered at each of the eight sites permits providing the heat to consumers in the vicinity at attractive price via district-heating network operators.
- **Inventory of potential consumers** has been built
- Socio-economic value estimate as compared to traditional heating sources is ongoing (CSIL)

Excavation materials societal benefits

- Locally innovative approach leads to **avoided costs from transporting and depositing** the excavation materials in distant quarries and mines in FR and CH
- The **quality of existing agricultural spaces can be improved** and **forests can be made climate-change fit**.
- Ongoing estimation of quantities of excavation materials in different locations.
- Re-useable quantities range from 10% to 60%.

A preview of results of the quantitative model

Share of measurable socio-economic benefits directly attributed to FCC-ee (preliminary)



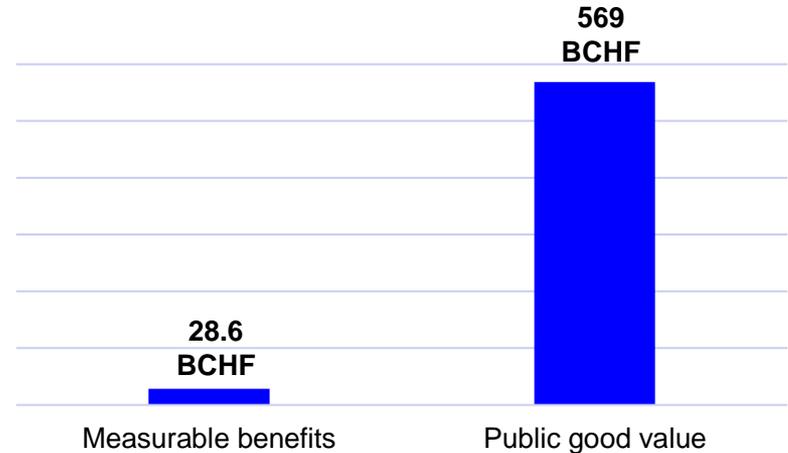
Benefit vs costs (preliminary)



Benefits and costs are discounted at a Social Discount Rate of 2%.

Measurable benefits vs the total public good value

- **On-line surveys** to representative samples of population in France, Switzerland, Germany, Israel, Italy, Japan, Poland, UK, USA: **10,448 total respondents.**
- **Estimation of their willingness to financially support FCC-ee, because of its perceived utility for humankind.**
- **Extrapolation of estimates** to other potential FCC-ee contributing countries.



The values are discounted at a Social Discount Rate of 2%.



Thank you
for your attention