20 Cost estimation

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20.1 Investment cost

A firm cost estimate can be made only after the detailed design has been chosen, the site has been selected, and the environmental conditions are known. At this time it is only possible to give some global figures. The average investment cost for the machine, based on experience from the previous projects ALBA, SOLEIL, DIAMOND, and MAX IV, is roughly €0.25 million per metre. For a circumference of 350 m, this comes to €87.5 million. Included in this number are the costs for the 100 MeV linac, 3 GeV booster synchrotron, 2.5 GeV storage ring, transfer lines, and front ends.

The necessary investments for the first generation of beam lines can only be estimated when future users have expressed their interests. The cost of individual beam lines varies enormously and can range from less than €1 million (infrared beam line) to several millions of euros for sophisticated beams. Assuming that the facility starts with three beams, a minimum investment of about €18 million would be expected. However, at present it has not been determined whether funding for the experiments should be included in the investment costs of the facility, since at least part of it could be provided by future users, be it in kind or in money.

It is assumed that the site will be provided free by the host state (this should be taken into account when comparing the total cost estimate made here with the cost of existing facilities, as the cost of the land made up a large proportion of the total cost for some projects).

It is very difficult to make an estimation of the cost of the building without knowing its location, because civil engineering costs vary considerably from country to country. Experience from other countries suggests an upper limit of about €45 million.

The overall initial investment for the SEE-LS is estimated to be in the range of €150 million to €160 million, taking into account the aforementioned uncertainties. This does not include the cost of laboratory staff.

Table 20.1 Investment costs for initial set-up (not including additional laboratories)

Item	Investment cost (€ million)
Linac, booster, storage ring, front-end beams, controls	88.0
First 3 beam lines (average €6 million per beam)	18. 0
Buildings and shielding	45.0
Laboratory staff during the construction	18.0
Total	169.0

For the design, following up the contracts, the installation, and the commissioning, around 40 people are needed (6 specialists from other SRLs for €110,000/year each, plus 15 engineers and 20 technicians for €66,000/year each). Overall it comes to €17.82 million for personnel during the construction period of six years, so that the total investment is estimated to be 150.5 + 17.82 ≈ 168 million euros (see Table 20.1).

The investments needed for the upgrades of the facility are presented in Table 20.2.

Table 20.2: Investments for possible upgrades (€ million)

Energy increase from 2.5 to 3 GeV	8
Additional beam lines: 10 (average €5 million per beam)	50
Total	58

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20.2 Laboratory staff

The staff of the laboratory would have to be built up during the years of construction. At the beginning, a few top experts will be needed, meaning that internationally competitive salaries will have to be offered. Over time and after training, the staff could come from all over the region. To operate the facility at turn-on, about 50 to 60 staff members would be required.

Simultaneously with the employment of staff, the operating cost would increase. Staff costs will depend on the salary scales adopted, so no definite figures can be given at this time. In western European laboratories the average cost of staff per person–year is about €0.061 million. Assuming that around two-thirds of the personnel would be remunerated according to local salaries, one might assume an average cost per year of €0.037 million. At the start of the project, the cost of the laboratory staff would be about €3 million per year.

20.3 Operational budget

The operating budget of the facility has two components, one that depends on the number of operating hours and another part that is constant.

The experience of most scientific laboratories shows that about 50% of the total budget consists of personnel costs, estimates of which have been given in the previous section. For a synchrotron light source, the material budget is to a large extent dependent on the cost of electricity, which could be as high as 25% of the total operating budget. With a consumption of 4.5 MW, an operation time of 6,500 h/year, and an electricity price of €100/MWh (western European prices), the total amounts to €3 million per year.

The local cost of electricity should be considered during site selection. On the other hand, electricity cost considerations might encourage the development of a solar power project, not just for this facility but also for the benefit of the whole region.

Upon adding costs for maintenance and consumables, the total yearly operating budget is estimated to be about €9 million, which would have to be covered by the collaborating partners (see Table 20.3).

Table 20.3: Yearly operating cost

Item		€ million
Maintenance and consumables		3
Laboratory staff	60 to 70 staff	3
Energy	3.0 MW (western prices)	2–3
Total		8–9