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Geothermal Development
A Private Company´s Experience

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Trust
Open- mindedness
Knowledge
Well-being

Mannvit's Offices

Headquarters in Reykjavík and 8 office in Iceland

Corporate Information

- Founded in 1963
- Employee-owned by over 100 shareholders
- Management Systems certified: ISO 9001, ISO 14001, OHSAS 18001

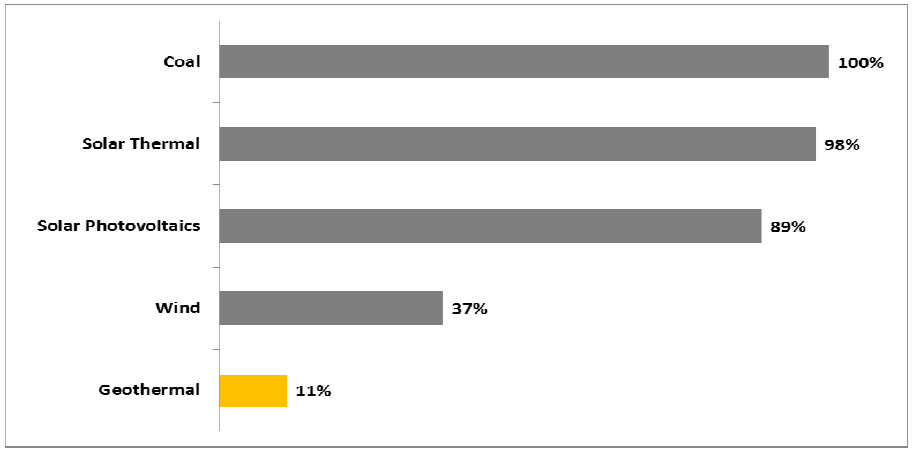
FS 551557 EMS 567779 OHSS 567778

Benefits of Geothermal

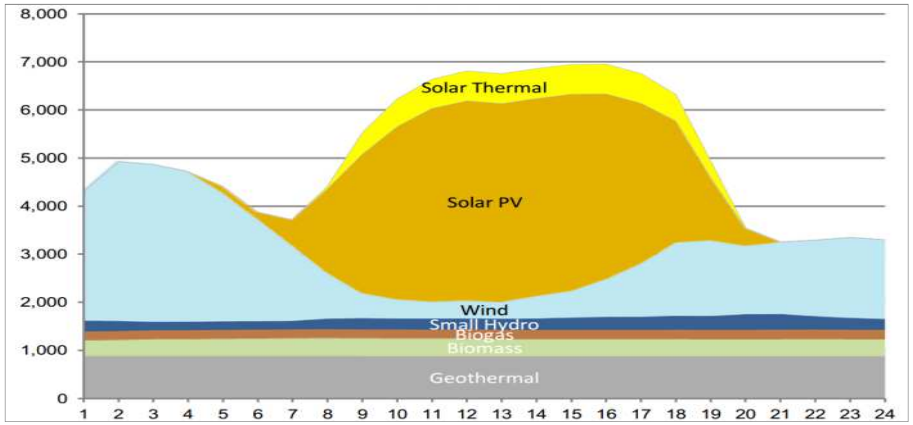
Geothermal energy offers several advantages over other energy sources

- Lower heat price for end-users
  - In the current environment geothermal district heating can reduce the heat price to end-users considerably
- Energy independence
  - Important for municipalities to be independent of external factors when it comes to energy supply
- Sustainable resource with high base-load
  - Geothermal energy is a sustainable source of energy which can provide a consistant base-load of heat
- Clean energy
  - Geothermal energy is considered a zero-emissions technology

30 Year Land Use Comparison



Base-load Nature of Geothermal Energy (MW vs. Hours)



Source: U.S. Geothermal Energy Association ("GEA"), California Independent System Operator Corporation ("CalISO")

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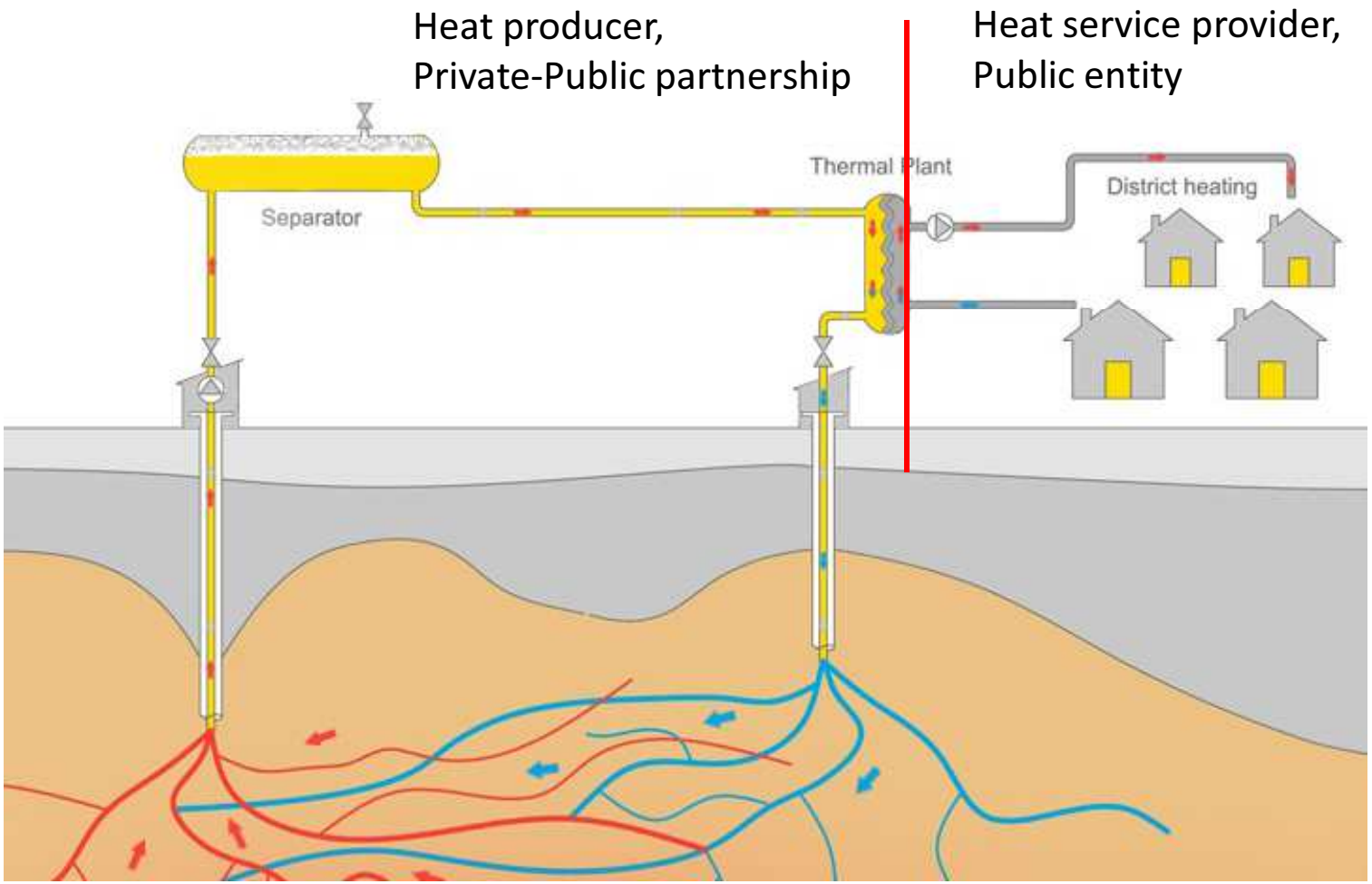
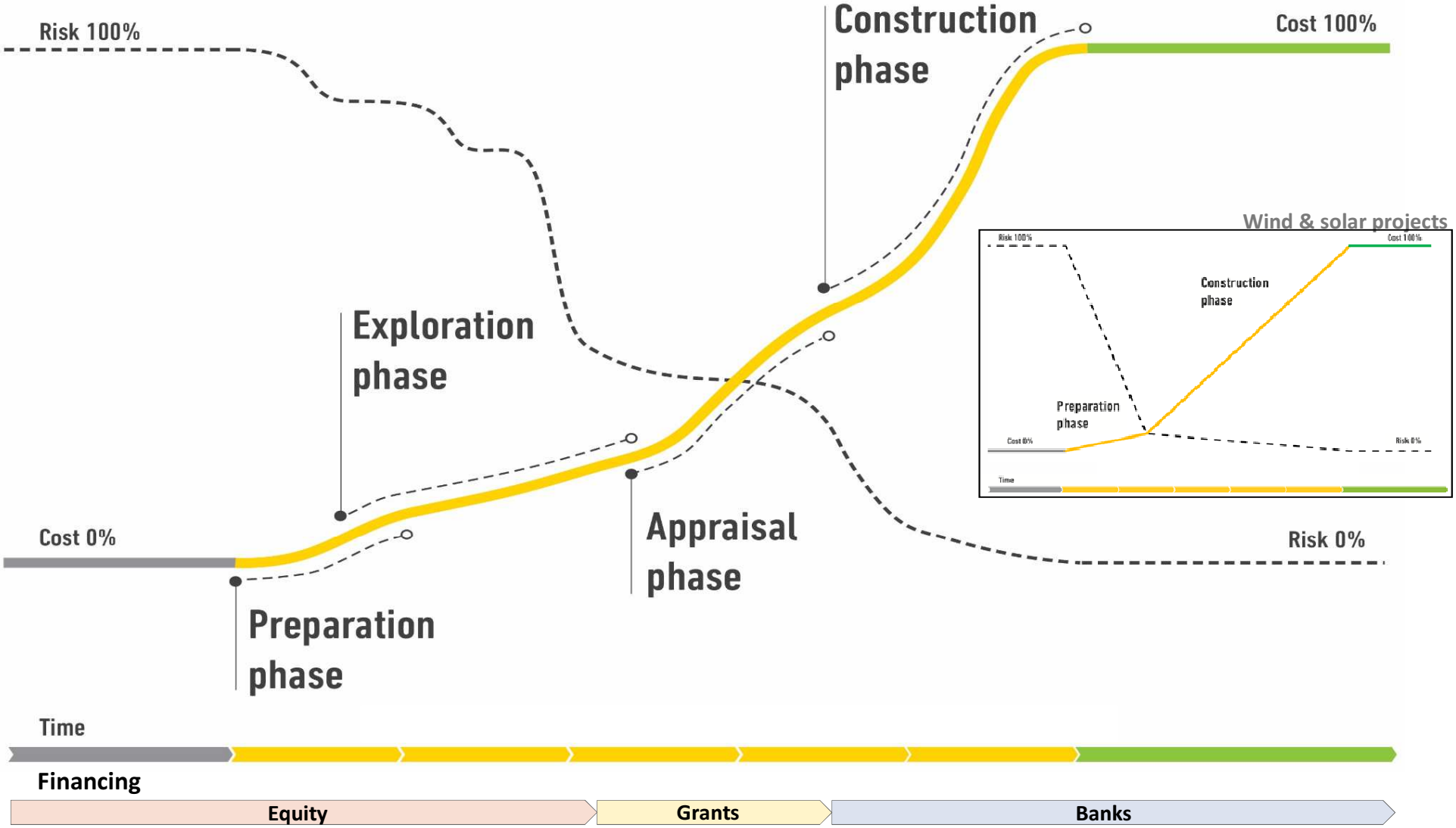
Private-Public Partnership



Project development

Investments in geothermal front-end loaded



Project development

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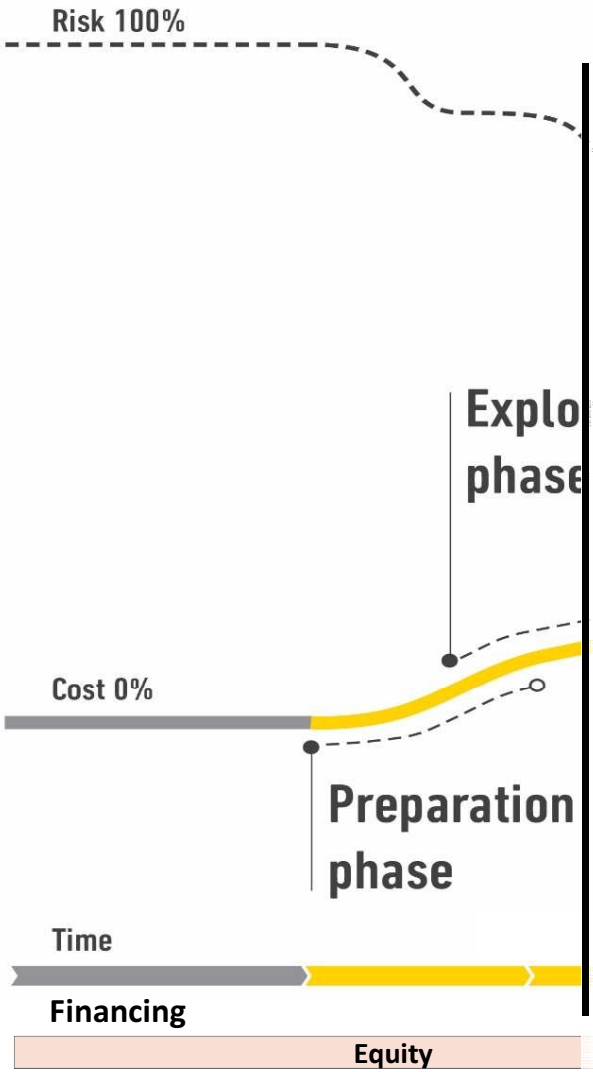
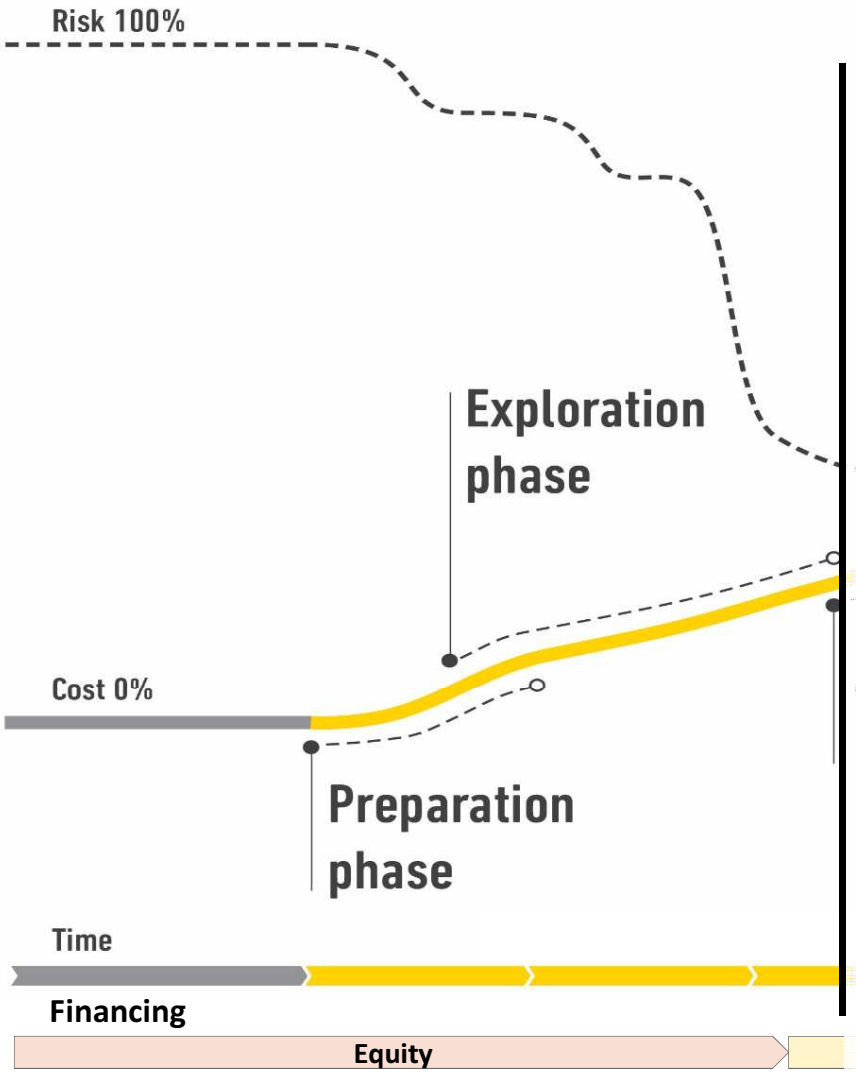


PREPARATION PHASE

- Geological & geophysical studies
- Pre-engineering, pre-feasibility, cost estimate
- Licensing, permitting, off-taker contract
- Grant application
- Duration up to 3 years
- Cost approx. 10% of total investment
- Awarded grants can cover up to 30-35% of project cost, drawn down over the whole development period
- Up-front payment but only if the project is fully funded
- Considerable equity still required for initial drilling
- Grant re-payable if drilling is unsuccessful

Project development

Investments in geothermal front-end loaded

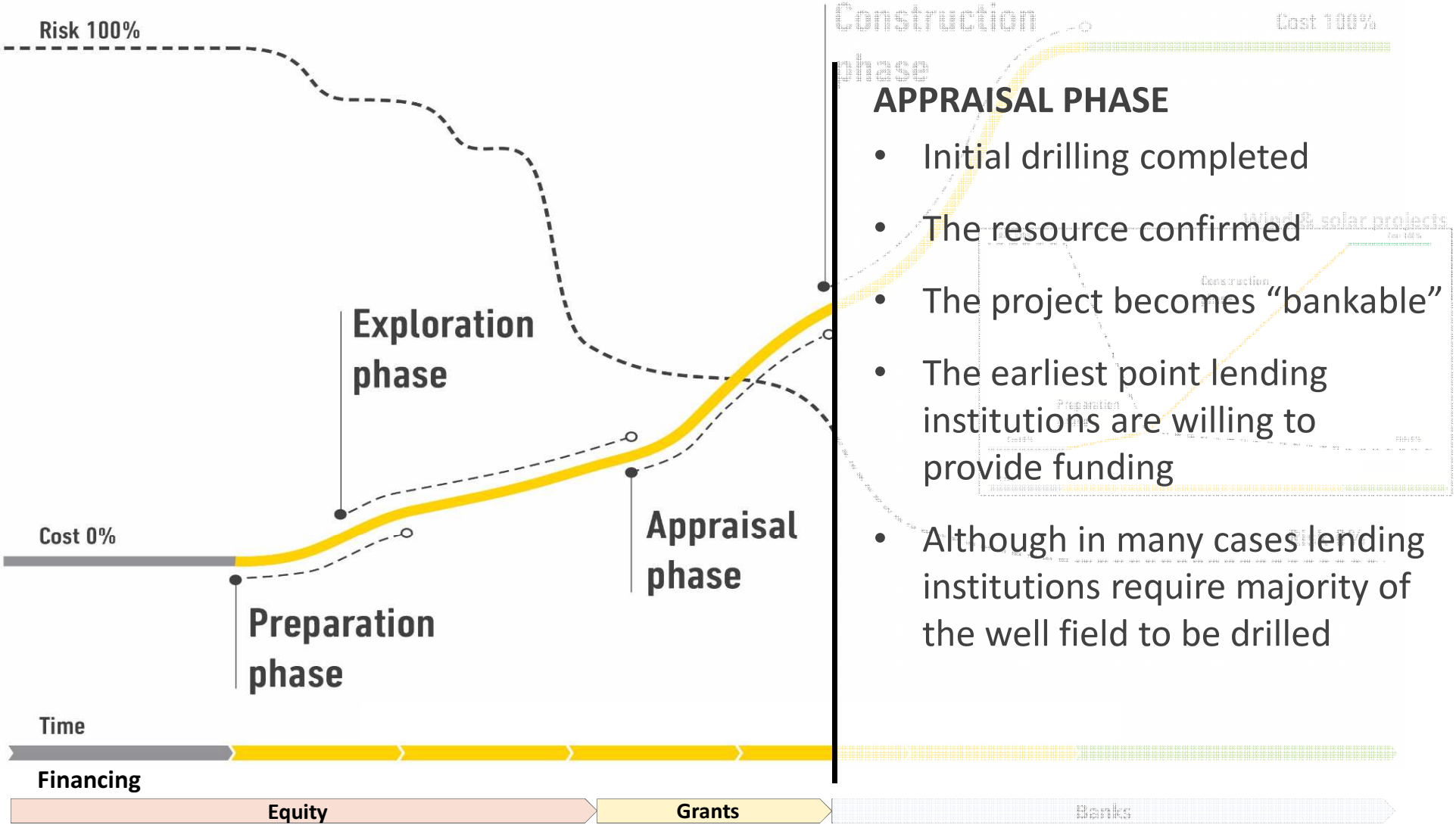


EXPLORATION PHASE

- Lack of drilling capital has been a barrier to geothermal development
- Financial markets have shown a poor understanding of geothermal development projects and tend to overestimate resource risk
- Lending institutions are unwilling to finance initial drilling and therefore equity is required to drill the first well
- Difficult to find equity investors willing to take on drilling/resource risk

Project development

Investments in geothermal front-end loaded



APPRAISAL PHASE

- Initial drilling completed
- The resource confirmed
- The project becomes “bankable”
- The earliest point lending institutions are willing to provide funding
- Although in many cases lending institutions require majority of the well field to be drilled

Conclusion

Support necessary at critical development stages

- Lack of drilling capital has been the main barrier to the development of geothermal energy
- Lending institutions not able to finance drilling while investors tend to overestimate resource risk
- Need for specilized sources of capital to bridge the gap between exploration and construction
- Current grant schemes need to be more efficient and focused on development stages where the financing need is the greatest
- Specialized source of capital for drilling, grant schemes and/or equity/bridge finance facility, would accelerate geothermal development immediatly

How did Iceland do it?

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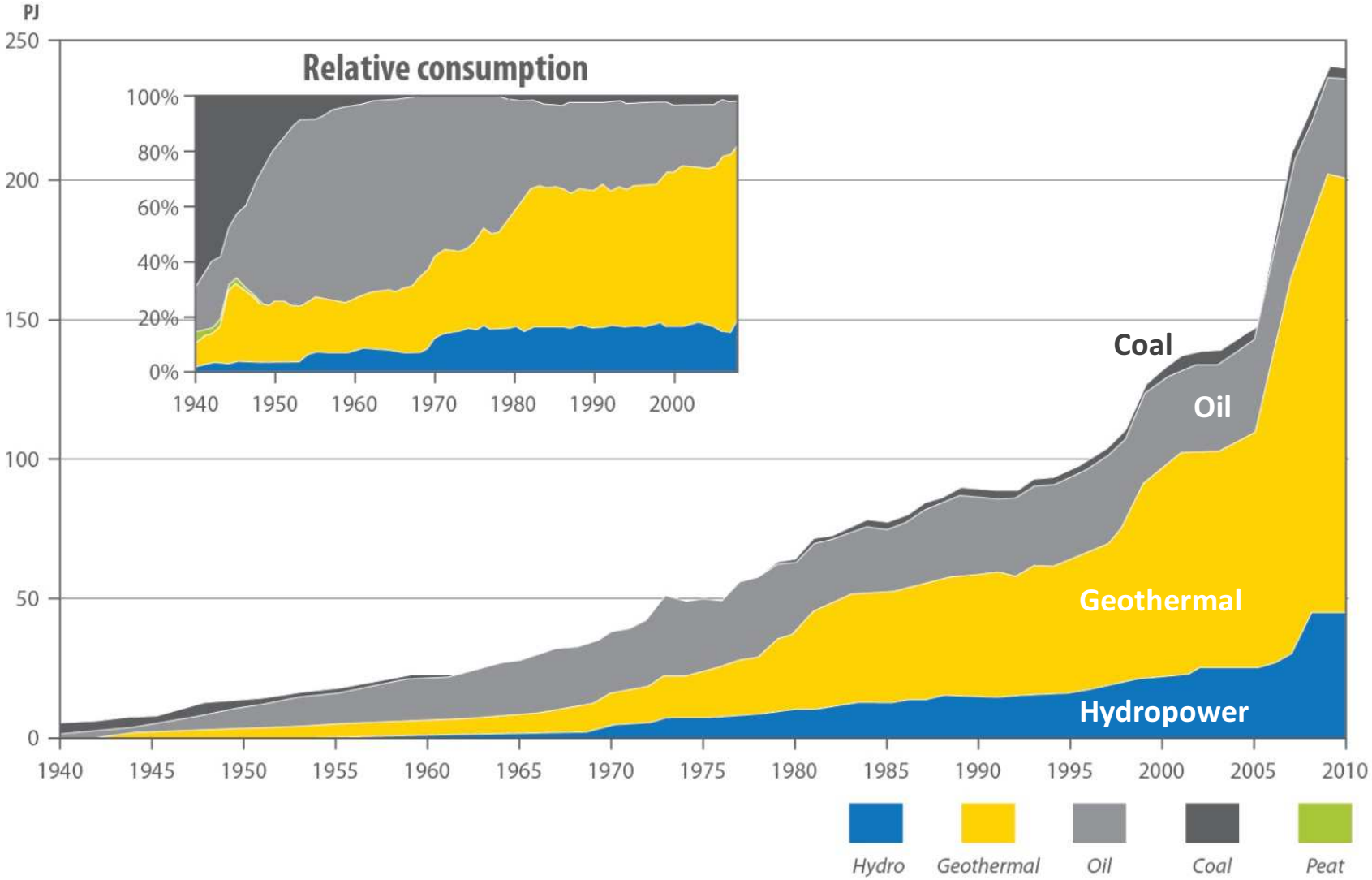
Primary Energy Use



Source: National Energy Authority Iceland

Government Support

Exploration and drilling

- In the 1970s the Government of Iceland established a mitigation fund
  - Prior to that, beginning in the 1930s, the Government conducted all exploration
- The fund provided financing for exploration and drilling
  - Loans not repayable if project was unsuccessful
  - Around 20% of projects unsuccessful
- The establishment of the fund resulted in significant acceleration in geothermal utilization
- The fund is still active today, although in a different format
  - Provides grant for geothermal exploration in “cold” and rural areas

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