

Geothermal Innovation

State of art and evolutionary roadmap

April 2016

GEO IBO

Executive summary:



Strong potential of Geothermal technology: Research and Innovation are fundamental for a better exploitation of the geothermal resources; the production plateau of the '70 has been fully recovered from the innovative ideas of reinjection, deep exploration and stimulation, never applied before in our field; Today we are facing with **new innovation frontiers**:

- **Better resource assessment** (exploration)
- **Better drilling technologies** (faster-cheaper)
- **Better efficiency in low temperature binary plants**
- **Better mitigation of corrosion and scaling**
- **Integrated modeling for improving operation**
- **Technological improvements** in major equipments
- Exploitation of the deep supercritical fluids
- Hybrid systems (sun-biomass-hydro)

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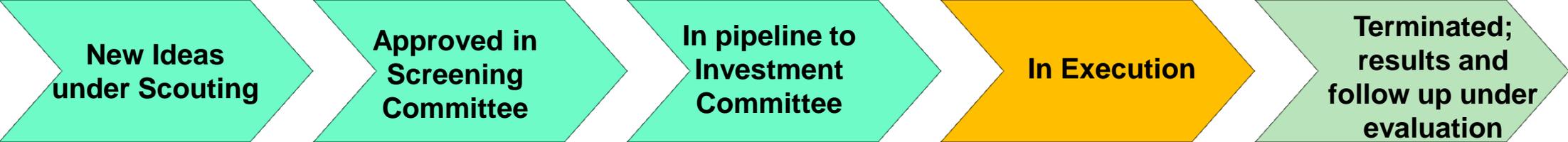
Strategy



STREAM	RATIONALE	TARGET	IMPACT
INNOVATIVE O&M	To increase plant performance and availability , with more automation for predictive maintenance ; to upgrade the operational activities using advanced diagnostic systems , with an holistic approach of the entire geothermal process.	Increase of production; reduction of O&M costs	
DRILLING TECHNOLOGIES	To intensify the effort in for drilling technologies, which are one of the criticalities of the value chain, considering both economical and resource exploitation aspects	Reduction of drilling cost; increase safety in drilling	
CORROSION & SCALING	To approach the corrosion and scaling problem, which are one of the most sensible operative issues ; improvement of actual technology for chemical or physical treatment and for monitoring systems (including cost reduction); new material anti corrosion and new operational procedure to mitigate its effect	Reduction of O&M costs; increase availability; more safety in operation	
CONVERSION EFFICIENCY	To improve the overall conversion efficiency in the cycle , both for binary plant and steam turbine, with special focus on medium resource temperature, as well as water saving issues;	Increase of production; less mining costs; better environmental impact	
EXPLORATION TECHNOLOGIES	To identify a better exploration technology, with new tools and an integrated modeling approach , in order to reduce the uncertainty in the resource assessment	Reduction of mining risk; better resource assessment	
HYBRID APPLICATIONS/ SUPERCritical FLUIDS	To intensify the efforts in a hybrid application of geothermal with other renewable and to increase the cascade utilization of heat; To develop supercritical resources , which are the new frontier of the geothermal exploration in Larderello and abroad.	Extending the resource basis to new frontier; better production	

Geo Innovation

Projects on pipeline



Exploration	GeoS: Model&Geophysical			IMAGE	MeProRisk
Drilling	GeoS: Drilling	INNODRILL		GOWELL DEEPEGS DESCRAMBLE	
Resource Exploitation	GeoS: Scaling&Corrosion			MERCURYSORB MERCURYREAD NEWGEOPLANT SALTRED MATCHING Hybrid Hydro Cove Fort	Hybrid Biomass Cornia Hybrid Solar Stillwater H2S Mitigation Soda Carbonate UPSTREAM underground LIQ-H2S

Project under development