

Typology of existing and innovative risk mitigation schemes

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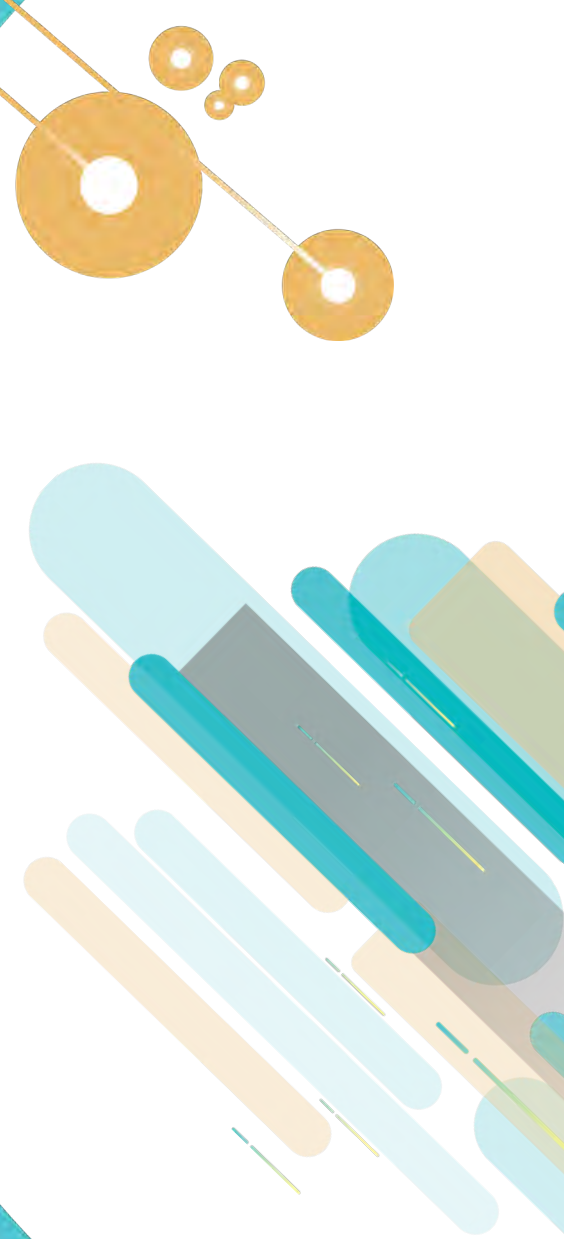
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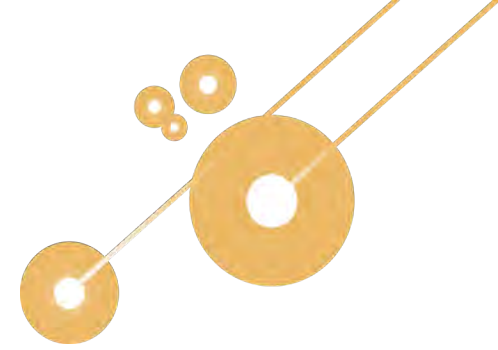
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1. Inventory of existing risk mitigation schemes
2. A detailed table with pro and cons
3. Lesson learnt
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Inventory of existing risk mitigation schemes: public, private and public-private

Numerous risk mitigation systems still existing or already terminated has been inventoried. Some had a very short time life duration as fully private insurance schemes and others a very long longevity, in general public funds with a possible public funds mixing in general public and private schemes)

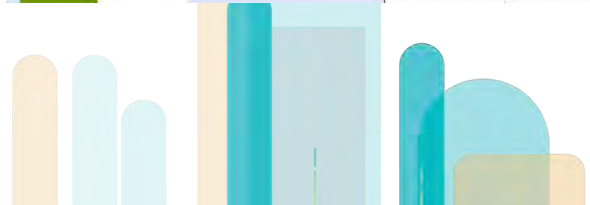
Geographically focused on Europe, the inventory has been carried out also worldwide for a total number of 23 schemes (4 not yet launched, 6 finished and 13 on going)

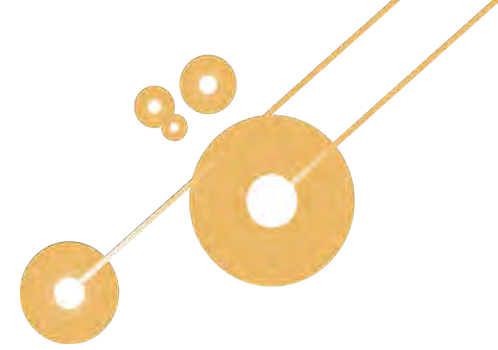
Europe (16): Netherland Geothermal Guarantee Scheme, Munich Ré - Private insurance scheme, KfW - Munich Ré Germany Geothermal Risk Mitigation, Geothermal Risk Mitigation – First scheme by MARSH, ART (Alternative Risk transfer) by MARSH, Icelandic fund, Swiss 1987, Swiss 2008, Swiss 2018, Turkey Early Stage Geothermal Development Framework: PLUTO, Turkish Risk Sharing Mechanism , Geofund, Polish Geothermal Risk Guarantee Fund, French risk mitigation scheme , EGRIF, GEODEEP SAS

Third countries (7): MiRiG, Mexico Geothermal Financing and Risk Mitigation Program, IRENA ADFD Project, ARGEO-RMF, GRMF, GDF Latin America, GeoFutures

Table presentation: Existing risk mitigation schemes

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
STATUS	FUND	FUND	CONTACT NAME	DATE	DURATION	% SPENT	EU	LATAM	AFR	ASIA	FUND SIZE	GRANTS or REVOLVING? % OF GRANTS	BREAKDOWN PER TYPE OF SERVICES	FUNDERS PUBLIC DFIs	
Ongoing	GRMF	Geothermal Risk Mitigation Facility for EASTERN AFRICA	grmf@roedi.com	Launched in 2012	7 years	70%	/	/	Ethiopia, Kenya, Rwanda, Tanzania, Uganda, Burundi, Comoros, Djibouti, Democratic Republic of Congo, Eritrea and Zambia	/	\$ 115 M	100% grants	-\$ 115 M grants	German Federal Ministry for Economic Cooperation Development (BMZ) KfW Department of English International Development (DFID)	Afri EU
Ongoing	GDF	Geothermal Development Facility for LATIN AMERICA	info@gdfiac.com	Launched in 2016	10 years	44%	/	Bolivia, Chile, Colombia, Ecuador, Peru, Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua	/	/	€ 50 M	100% grants	-€ 50 M grants, early stage only - ??? INVESTMENT VEHICLE TOO	German Federal Ministry for Economic Cooperation Development (BMZ) KfW AFD (french development agency) CABEI (Central American Bank for Economic Integration) Japan International Cooperation Agency (JICA)	Eur (EIE Wo EU Intr Bar CAF lati
Ongoing	MUNICH RE-INTERNATIONAL	International Exploration Risk - PRIVATE Insurance	MToennis@munchre.com	Launched in 2015	NA	NA	/	Bolivia, Chile, Colombia, Ecuador, Peru, Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua	Kenya	/	NA	Private insurance 0% grants	NA	/	/
Finished	MUNICH RE-GERMANY	GERMAN Exploration Risk - Private Insurance	MToennis@munchre.com	Launched in 2003	NA	NA	Germany	/	/	/	NA	Equity, Debt and Premium 0% grants		/	/
Finished	GERMAN PUBLIC SCHEMES	GERMAN Geothermal Risk Mitigation - PUBLIC schemes	MToennis@munchre.com	Launched in 2009		100%	Germany	/	/	/	€ 60 M	Loan revolving 0% grants	- 60 € M loan	KfW BMUB (german federal Ministry for the environment, nature conservation, building and nuclear safety)	/





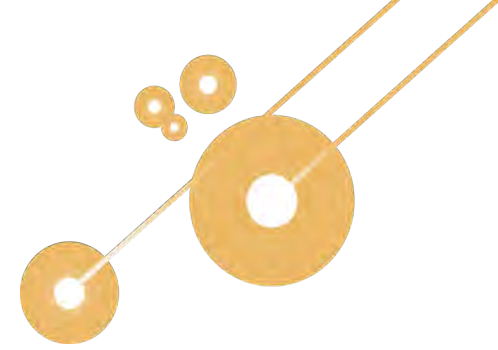
Lessons learnt

14 schemes are national, 9 have international scope, generally in only one region of the world (Africa, Latam, Europe).

11 funds are based on multilateral development and/or public financing (GDF LA, GRMF, PLUTO, Turkish RSM, Mexico, MiRig, RMF ARGEO, GEOFUND, IRENA ADFD, Geofutures, and EGRIF)

9 funds are national public initiatives, held over time in only in 6 countries: France (SAF Environnement, GEODEEP SAS), Switzerland (Swiss 1987, Swiss 2008, Swiss 2018), Germany, Netherlands, Poland, Iceland

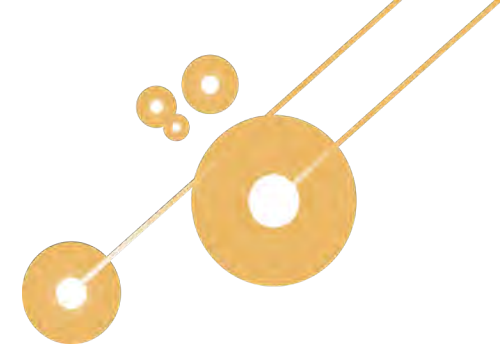
Only 3 funds were pure private initiatives, mostly located in Europe (ART, Munich Re Private Insurance Scheme, Marsh A).



Very diversified forms

The service provided to exploration campaigns takes diversified forms

- Pure grant (GRMF, Swiss 1987, Swiss 2008, Swiss 2018)
- Subsidized refundable advances with low/partial repayments to the Fund in case of success (GDF LA, Mexico, German National Scheme)
- Subsidized warranty, with low premiums (SAF Environnement, Turkish RSM, NL Geothermal Guaranty Scheme, ARGEO RMF, EGRIF)
- Concessional Loan repaid to fund in both success and failure cases (PLUTO, Mirig, IRENA ADFD)
- Hybrid Public-Private scheme: Subsidized Warranties with low premium and royalties in case of success (GEODEEP SAS)
- Hybrid Public Private scheme : Private Warranty with real cost premium, Premium covered by a refundable advance by the public fund (Mexico, Geofutures)
- Private unsubsidized Warranties with real cost premiums (Munich RE Private Insurance Scheme, Marsh A),
- Private unsubsidized Warranties with low premium and royalties in case of success (ART)

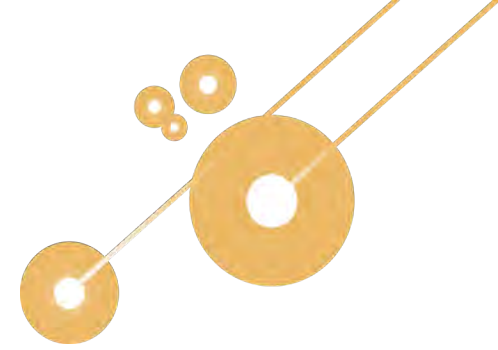


First and second family

A first family is highly successful, with many developers applying, supported projects and geothermal plants completed. It includes mostly long-existing European schemes devoted to Heat Generation such as SAF Environnement, Swiss 1987, The Netherlands Scheme, the German National Scheme.

A second family encompasses attractive funds, in the way they attracted many applicants and awarded many supports, yet all money has not been cashed out and the completion of plants actually connected to the grid is still expected. Such funds are GRMF and GDF LA. The latter benefitted from the learnings of the former.

Recently launched public funds such as Turkish RSM and Swiss 2018 look promising. 8 projects are already engaged in the application process for the Turkish RSM. Swiss 2018 has officially accepted their first projects a few months after its launch.

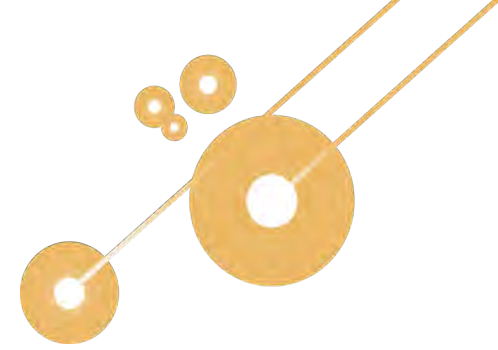


Third to fifth family

A third family gathers unsuccessful public funds either because of unattractive service (Swiss 2008, Pluto, IRENA ADFD), insufficient funding (ARGEO RMF, GEOFUND) or adverse local market conditions for geothermal energy due to competition with cheap wind and solar power (MiRig, Mexico)

A fourth family gathers the unsuccessful private schemes, mostly because either the risk borne is too high or because of unattractive high premiums (Munich Re Private, Marsh A, ART)

A fifth family gathers the projects to come, such a EGRIF, GEOFUTURES, GEODEEP SAS. EGRIF should be much inspired from the French SAF Environment. GEOFUTURES has a sophisticated approach intending at solving barriers both on developers and stakeholder's sides, at the cost of a certain complexity. GEODEEP SAS is limited to EGS in France is a public-private structure waiting the green light from the DG COMP of the European Commission.

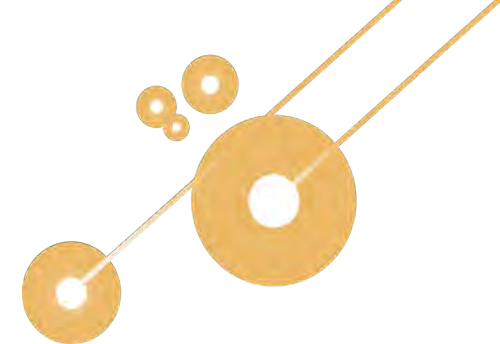


Coverage approach

The coverage of the costs for exploratory campaigns range from 40% (example GRMF, through grants) up to 80% - 90% (SAF for Region Ile de France). Major funds such as GRMF and GDF cover only 40% of exploratory campaigns.

At 40%-60% coverage rate the risks remain important for the developer. Specifically in Europe funds with an 70%-90% coverage have demonstrated their attractiveness. For example in Switzerland, the first fund covered 60% to 80% of the drilling costs and proved very successful. A second Swiss fund lowered the coverage to 50%, resulting in only one project applying for support. The last Swiss fund corrected the trend up to 60% on the whole process from preliminary studies to drillings.

The comfort zone is obviously above 60%, without impairing the commitment of the developers.



Conclusions

In conclusion, key learnings for a future GEORISK fund addressing European region :

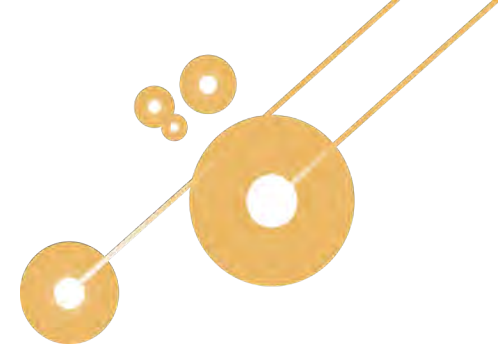
- Cover electricity, heat and cogeneration plants
- Base the project on the French SAF Environnement and the Netherlands Scheme already taken into account in the EGRIF proposal
- Improve it based on the Turkish RSM example with increasing coverage rates in regions with poor geological knowledge
- Adopt a 60% coverage as a strict minimum, up to 80-90% if possible
- Long Term risk coverage is attractive but only sustainable with many projects applying to the fund
- Low premiums in the range of 3 to 7% (NL and SAF Environnement schemes) are needed, therefore requiring a certain level of concessionality.



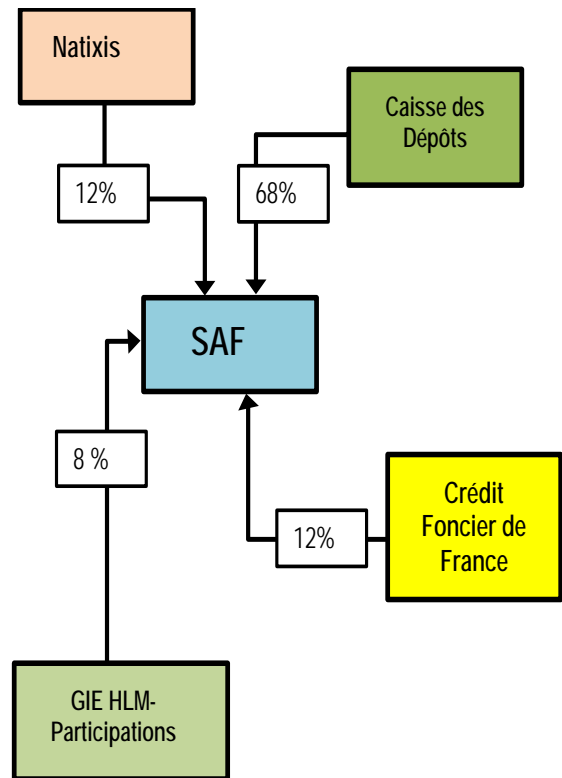
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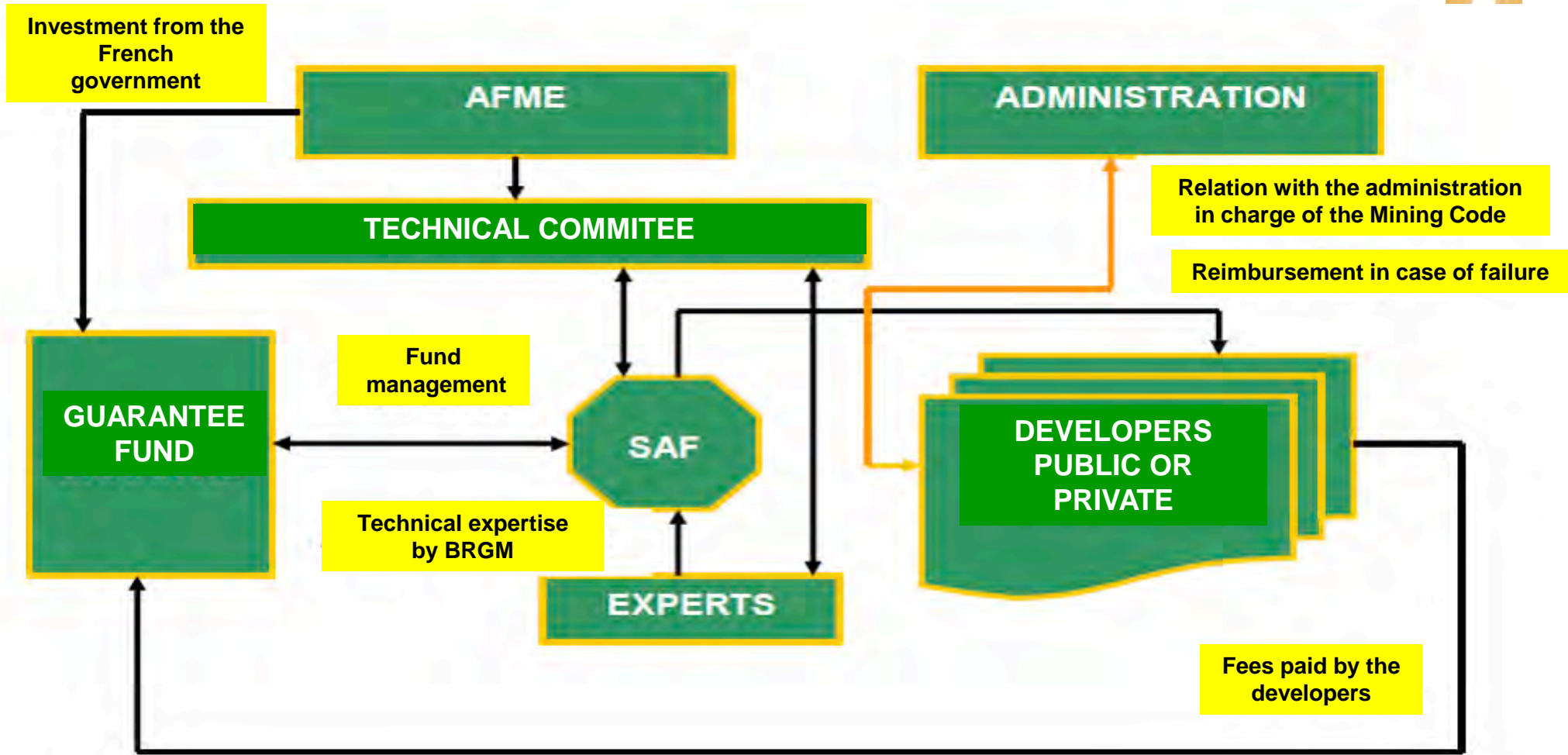
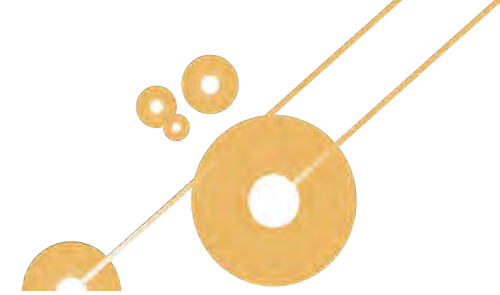


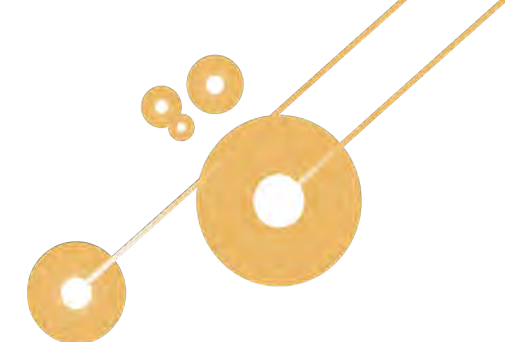
Example of the French fund created in 1980



- Natixis is a private bank
- Caisse des Dépôts et Consignations is the French state bank
- SAF is a subsidiary of Caisse des Dépôts et Consignations
- Crédit Foncier de France is a bank active in construction
- GIE HLM participation is an aggregate of companies which are building and exploiting low cost collective housings

Operating the Fund





The 2 funds: short term and long term re-initialised in 2008

End of 2017 the resources of the fund were at 13,8 M€

- Subsidies from ADEME (French Government) + 9 M€
- Subsidies from Ile de France Region +1,30 M€
- Fees from developers: +7,4 M€
- Financials products: +0,8 M€
- Reimbursements, expertise and management: - 4,7 M€

31 short term contracts signed which demonstrate that even with a very good geological and hydrogeological knowledge, the developers continue to subscribe after nearly 40 years of drilling in the Paris basin area (one failure since 2008)

15 long term contracts signed for 20 years (one failure since 2008)

The exploitation period, of about 10 years, represent 250 M€ guaranteed with a leverage effect of **28 for 1 euro** granted by the French government.

For the long term fund, 170 M€ are guaranteed with a leverage effect of **19 for 1 euro** granted by the French government