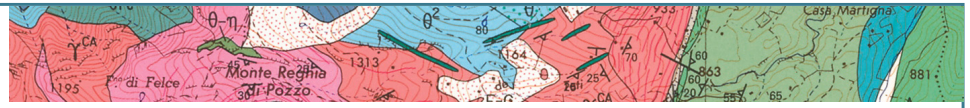
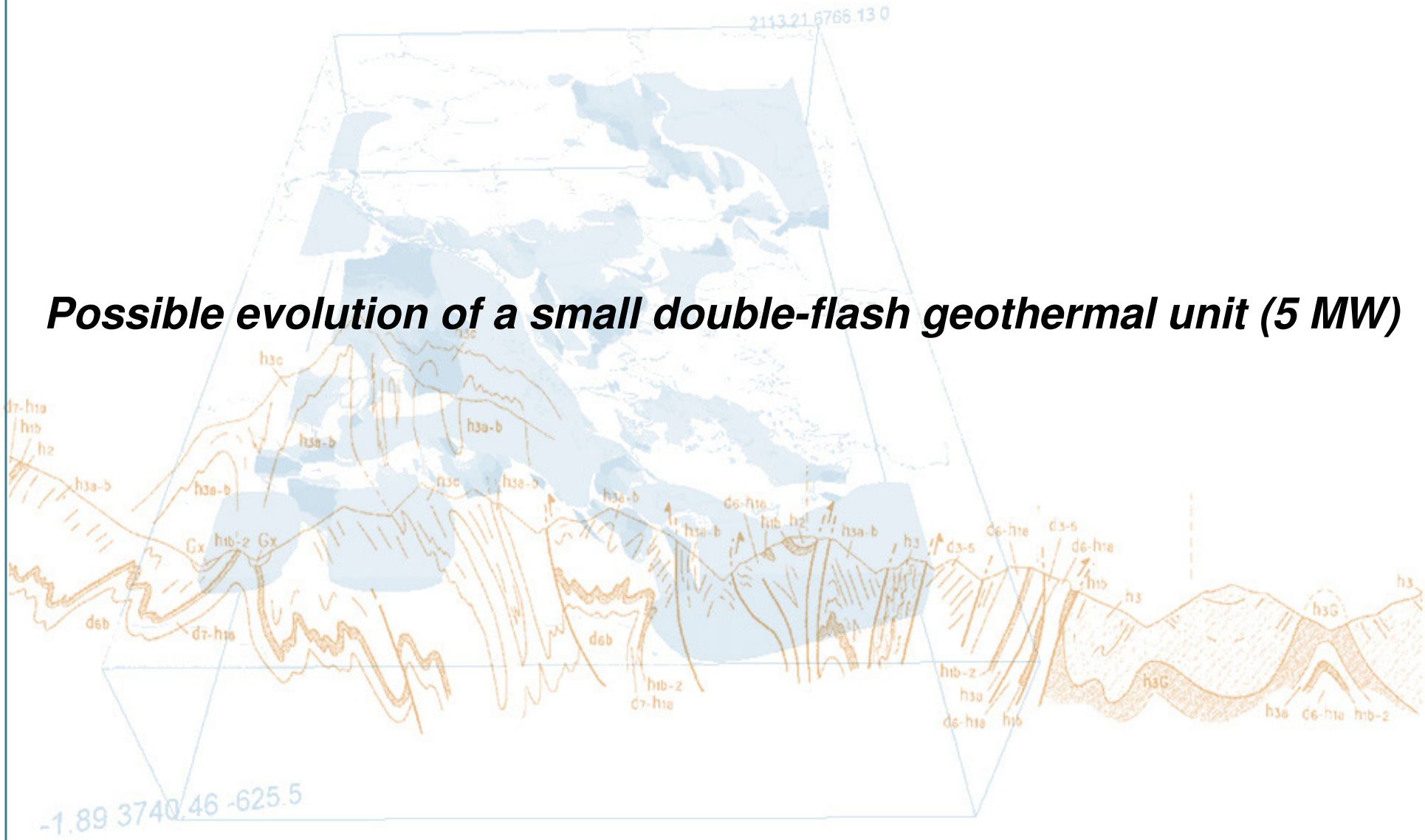


Possible evolution of a small double-flash geothermal unit (5 MW)

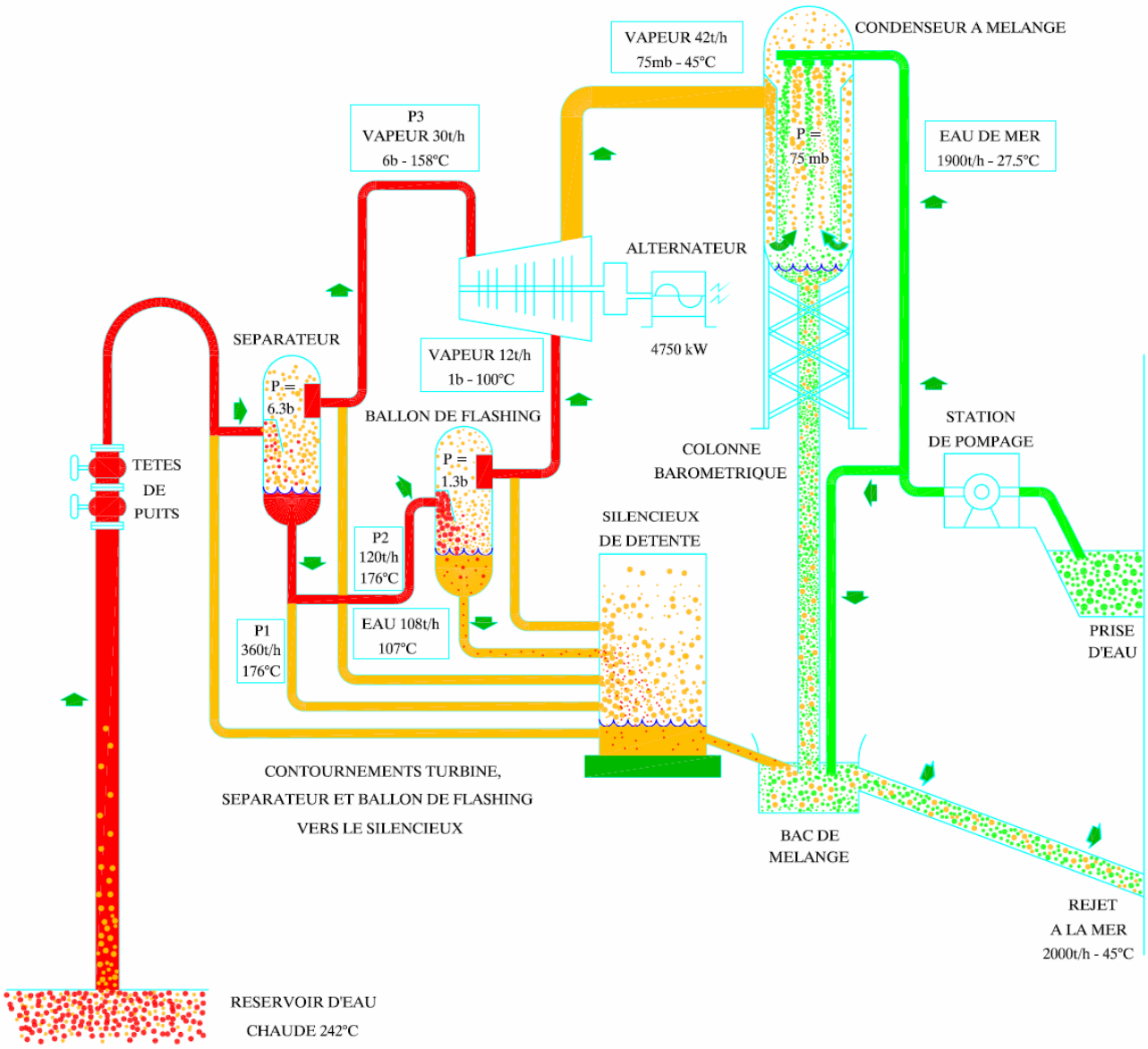


cfg services

Bouillante 1 et 2 - Vue générale de la centrale

cfg services

cfg services



cfg services

Preliminary calculations done taken into account, the experience on Bouillante geothermal field (Unit GB1)

- Hypothesis 1 : New investment for a double flash turbine
- Hypothesis 2 : idem 1 + small binary on separated water (after HP separator)
- Hypothesis 3 : Single flash turbine (HP only) and larger binary cycle on all the separated water available
- Hypothesis 4 : Binary cycle unit only (no steam flash turbine)

cfg services

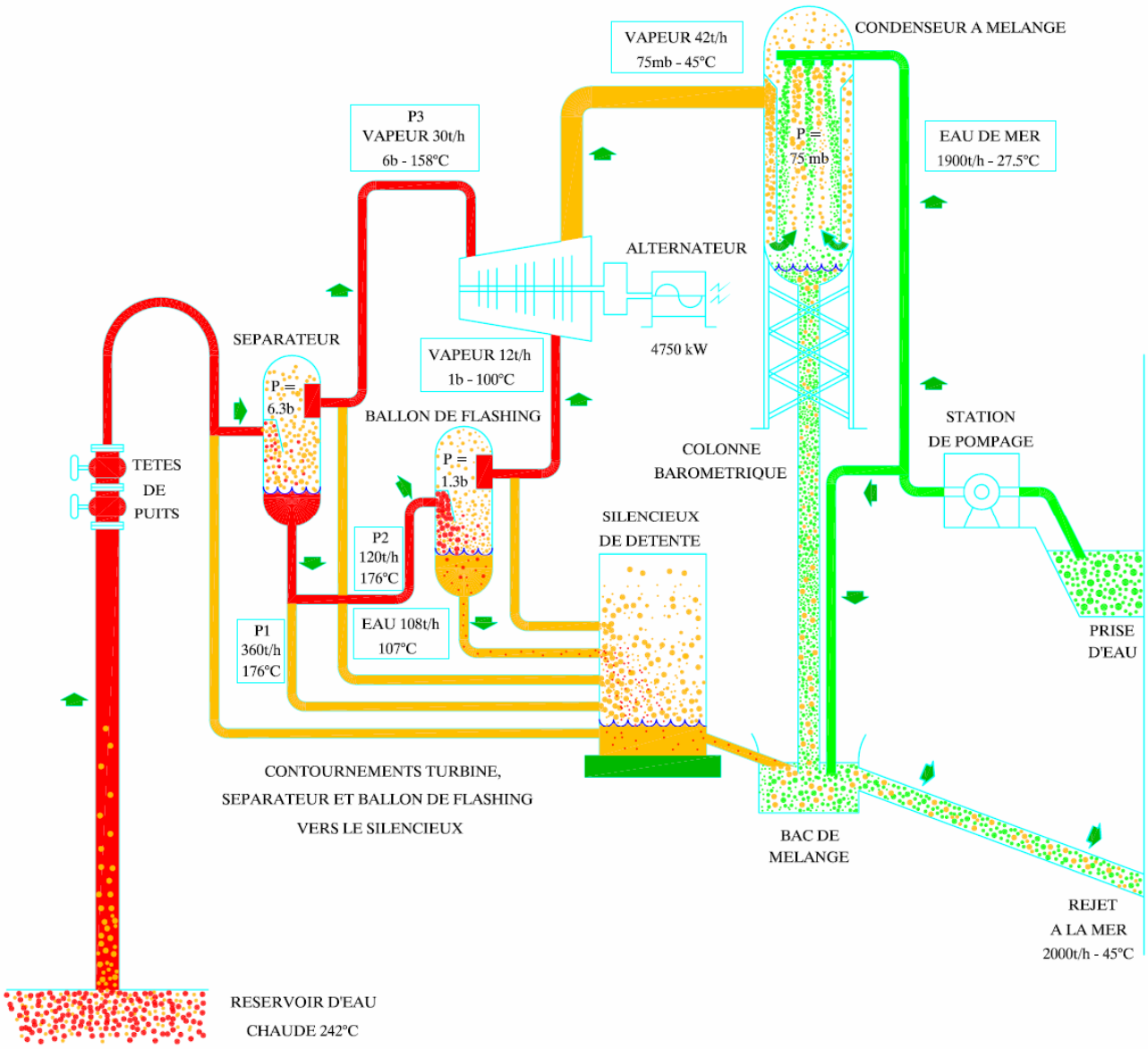
Option 1

4,7 MW gross power double-flash turbine

- Contribution to initial cost of the wells : 4100 k€
- Preliminary estimation for next revamping : 12400 k€
- Net power output : 4 MW
- Availability (net power) : 80 % (average year)
- Selling price : 0,10 €/kWh

cfg services

Option 1



cfg services

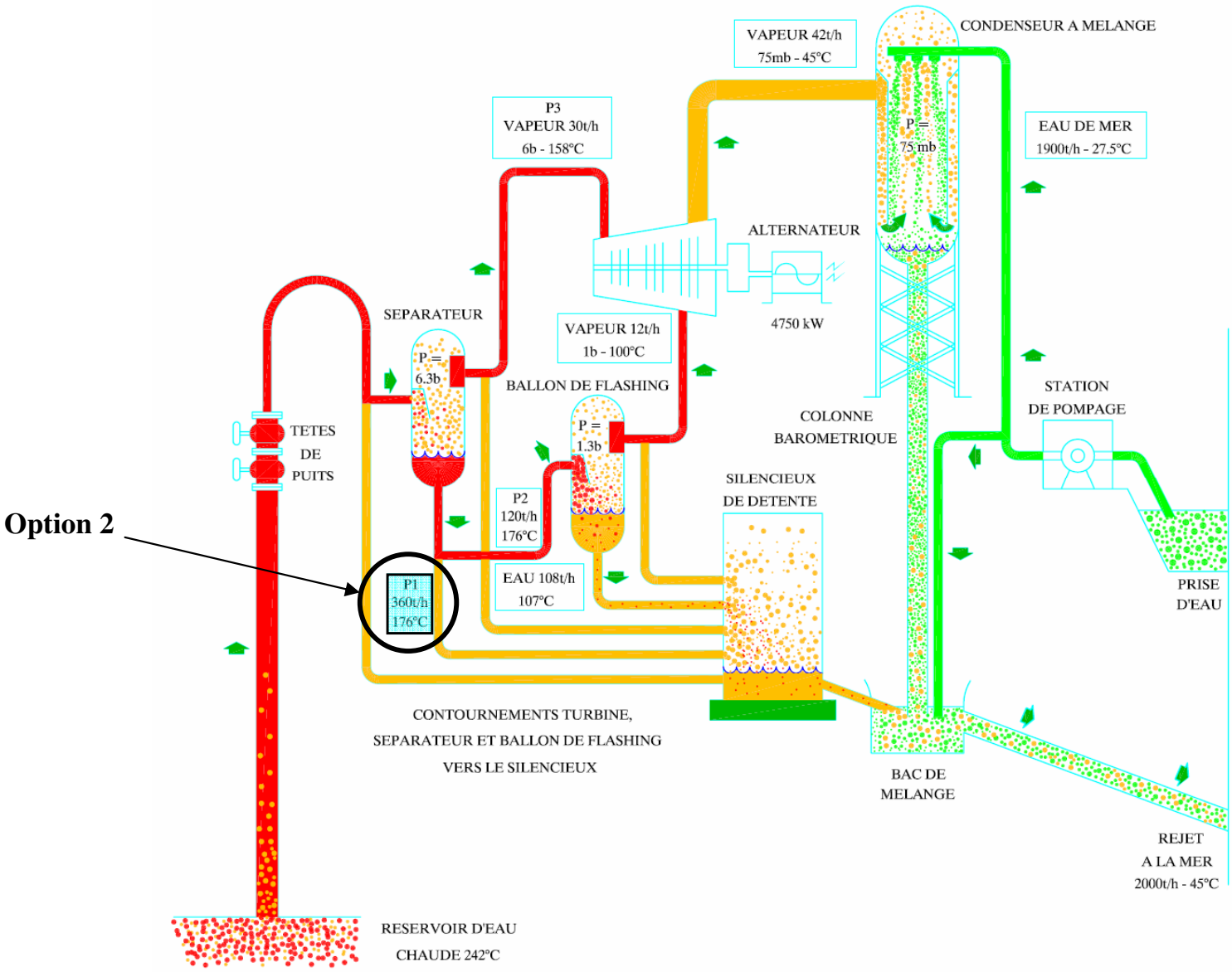
Option 2

4,7 MW gross power with double-flash turbine (see option 1) + binary cycle on separated water (360 t/h high pressure water after HP separator)

- Double-flash turbine ; same option 1
- Binary cycle and power plant modifications :
  - ► 6500 k€
  - ► 3,7 MW net output
  - ► entry to binary : 360 t/h / 176°C
  - ► exit from binary : 360 t/h / 115°C
  - ► operating costs estimated to : 260 k€/year
- Total net output : 7,7 MW

cfg services

Option 2



cfg services

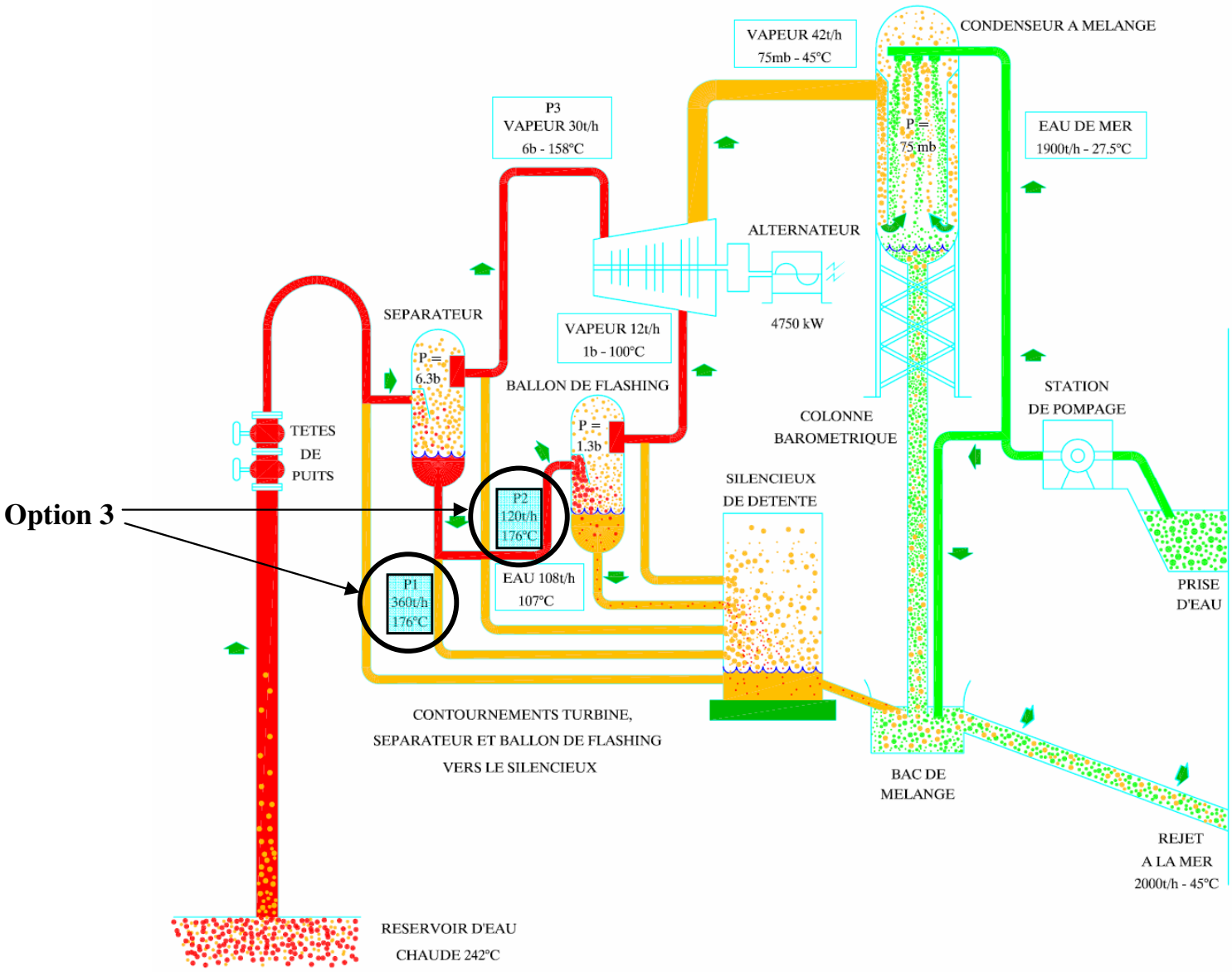
Option 3

4 MW gross power with single-flash turbine (HP only) + binary cycle on separated water (480 t/h)

- Single-flash turbine net output : 3,5 MW
- Binary cycle and power plant modifications :
  - ► 6800 k€
  - ► 4,5 MW net output
  - ► entry to binary : 480 t/h / 176°C
  - ► exit from binary : 480 t/h / 115°C
  - ► operating costs estimated to : 300 k€/year
- Total net output : 8 MW

cfg services

Option 3



cfg services

Option 4

Existing double-flash turbine totally replaced by a large binary power plant

- Binary power plant investment estimated to 14000 k€

(including decomissioning of actual double-flash equipment)

- Gross output : 7,6 MW
- Net output : 7 MW
- Entry to binary : 480 t/h water / 176°C

  32 t/h steam 6,5 b
- Availability : 92 %
- Production 56400 MWh/year, 0,10 €/kWh

cfg services

Comparison of the IRR (project) calculated after 15 years exploitation (constant money)

			2020 (15 ans)									Power (net)
			-10%			0%			10%			
			Montant	TRI	RETOUR	Montant	TRI	RETOUR	Montant	TRI	RETOUR	
H1	1	Initial investment	14850,0	5,88%	10,2 ans	16500,0	3,53%	12 ans	18150,0	1,53%	13,2 ans	4 MW
	2	Annual turn-over	3136,3	0,60%	0,0 ans	3484,8	3,53%	12 ans	3833,3	7,28%	9,6 ans	
	3	Operating costs	1223,5	5,20%	10,5 ans	1359,4	3,53%	12 ans	1495,3	1,79%	13,0 ans	
H2	1	Initial investment	20970,0	22,89%	5,0 ans	23300,0	19,03%	5,9 ans	25630,0	15,92%	6,5 ans	7,7 MW
	2	Annual turn-over	6037,4	14,40%	6,9 ans	6708,2	19,03%	5,9 ans	7379,0	23,72%	4,9 ans	
	3	Operating costs	1573,6	20,38%	5,5ans	1748,4	19,03%	5,9 ans	1923,2	17,68%	6,2 ans	
H3	1	Initial investment	20790,0	27,71%	3,8ans	23100,0	23,31%	4,7 ans	25410,0	19,82%	5,3 ans	8 MW
	2	Annual turn-over	6507,9	18,27%	5,7ans	7231,0	23,31%	4,7 ans	7954,1	28,52%	4,2 ans	
	3	Operating costs	1612,0	24,72%	4,6ans	1791,1	23,31%	4,7 ans	1970,2	21,90%	4,9 ans	
H4	1	Initial investment	16290,0	29,09%	4,2ans	18100,0	25,28%	4,7 ans	19910,0	21,49%	5,3 ans	7 MW
	2	Annual turn-over	5488,6	19,73%	5,7ans	6098,4	25,28%	4,7 ans	6708,2	31,06%	4,1 ans	
	3	Operating costs	1415,4	26,91%	4,5ans	1572,7	25,28%	4,7 ans	1730,0	23,66%	4,9 ans	

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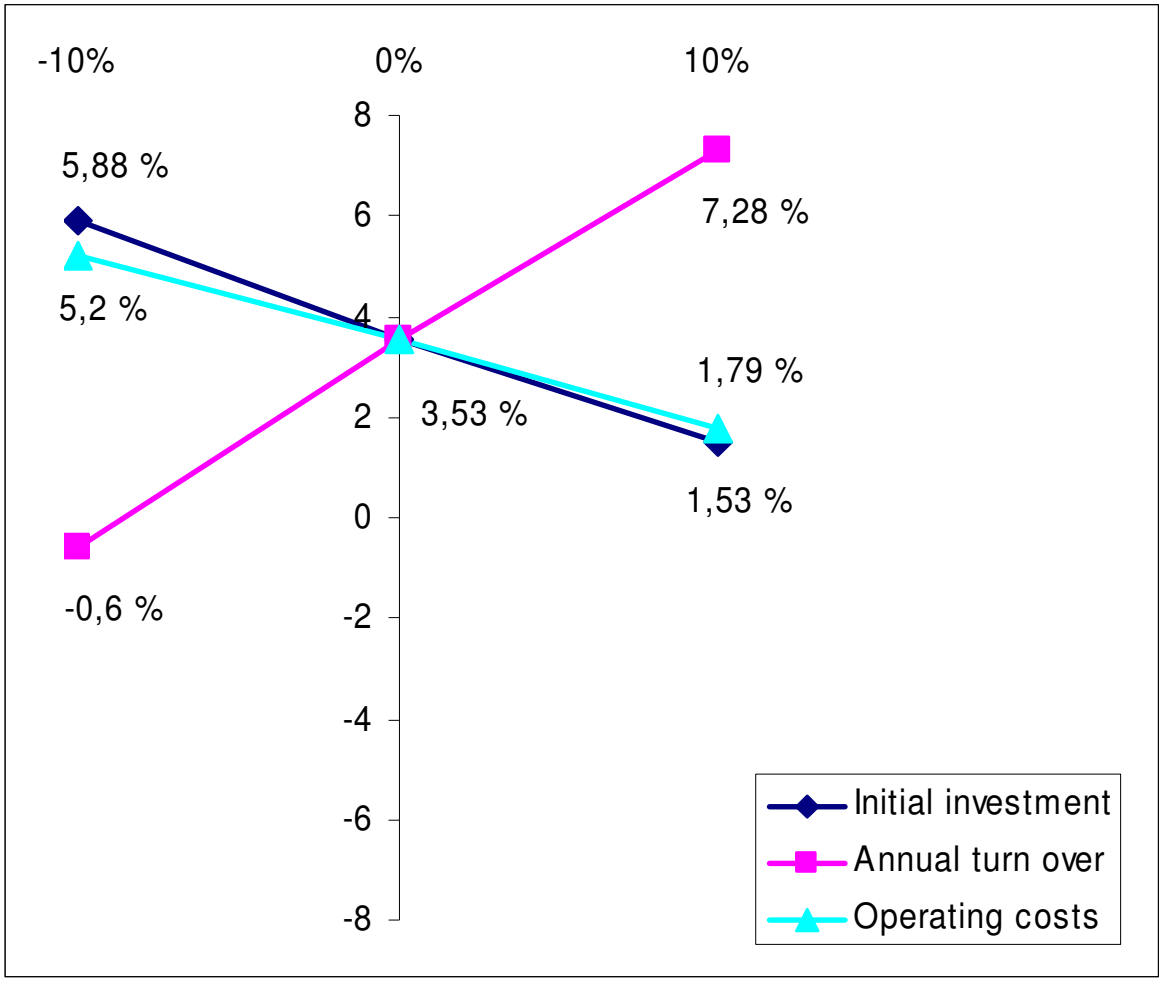
Hypothesis 1

New investment for a double flash turbine



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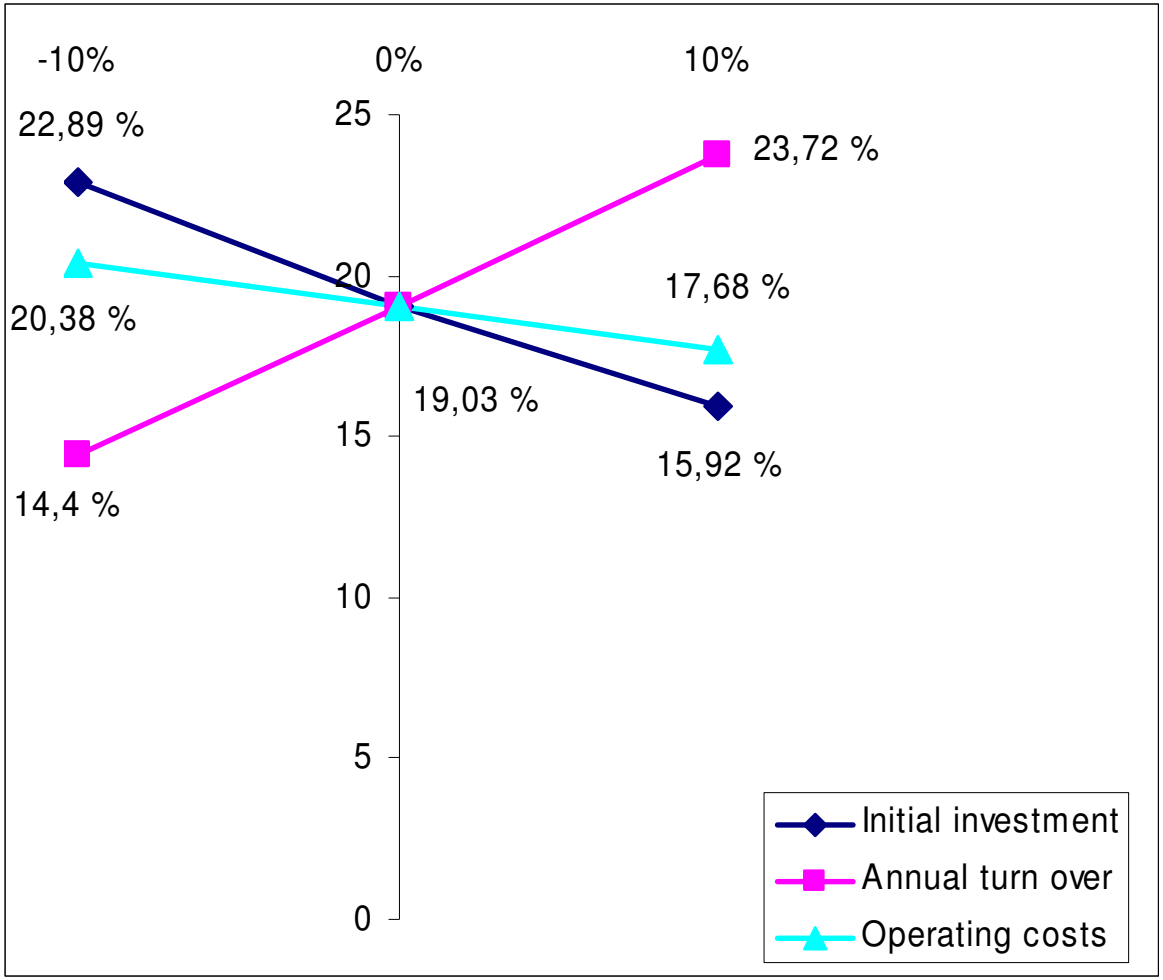
Hypothesis 2

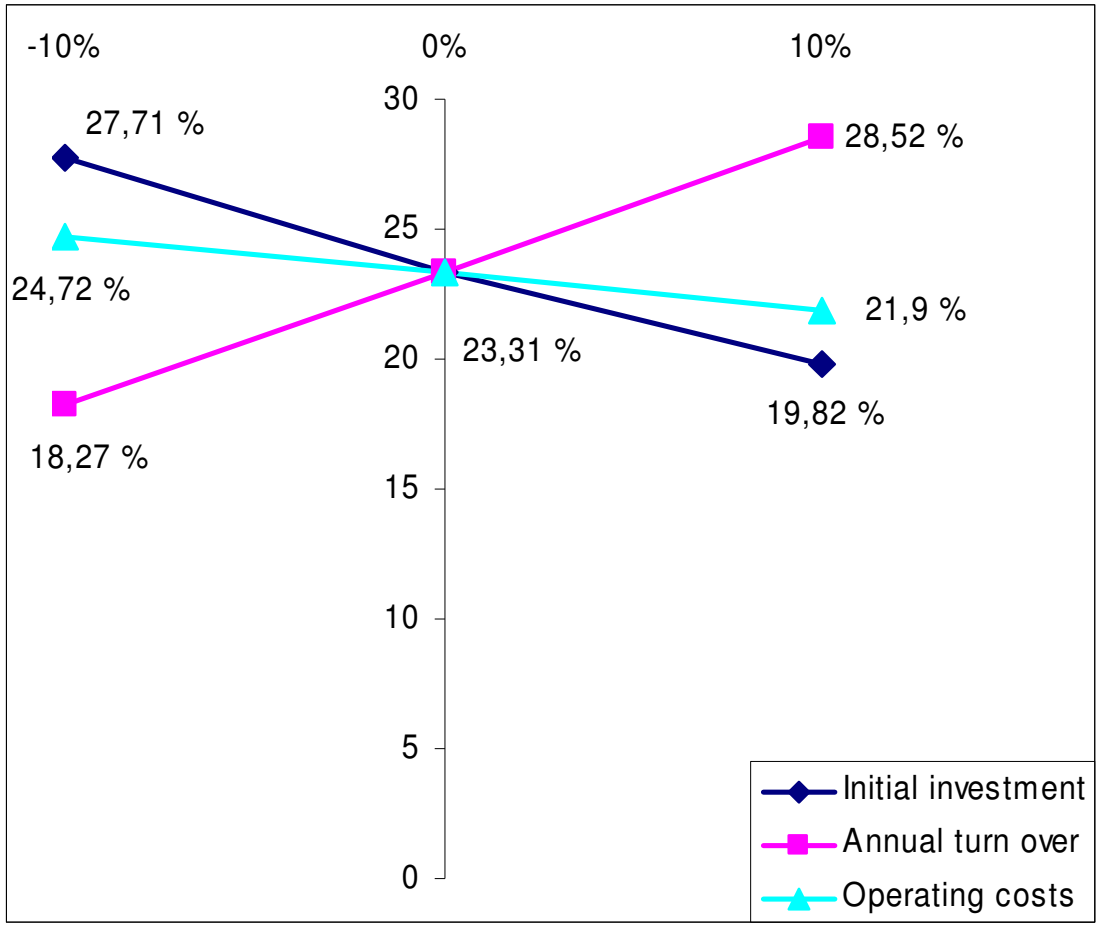
Idem 1 + small binary on separated water (after HP separator)



cfg services

Hypothesis 3

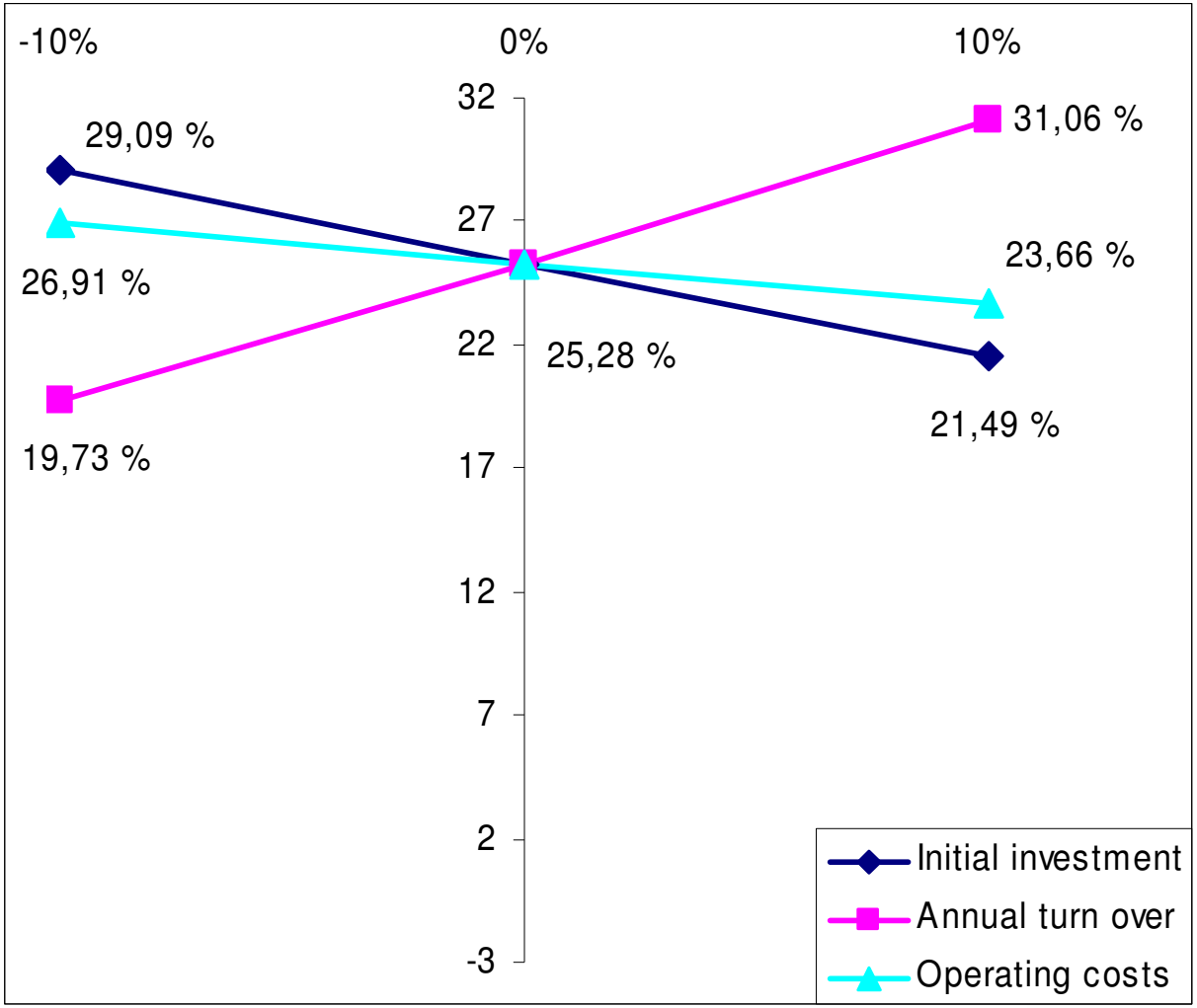
Single flash turbine (HP only) and larger binary cycle on all the separated water available



cfg services

Hypothesis 4

Binary cycle unit only (no steam flash turbine)



cfg services