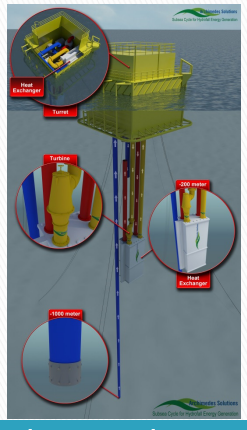
OTEC by SCHEG

Subsea Cycle for Hydrofall Energy Generation

Presentation at OTEC for Africa
October 2013
Harold Lever

SCHEG: A new concept, why?



Artist impression
(not to scale)

- Compact floating platform, more buoy than platform
- Optimized for 10-20 MW, lower investment hurdle
- Basic technologies well understood and proven
- The combination and the application is new
- Serial production is well conceivable

Affordable Sustainable Energy for coastal cities

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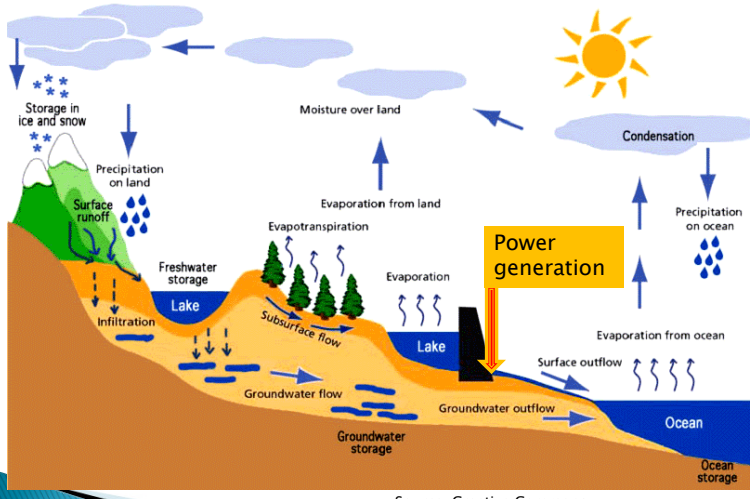
SCHEG: inspired by nature: the hydrological cycle



Source: Creative Commons
http://www.kasgeography.co.uk/doku.php?id=as_a2:the_drainage_basin_hydrological_cycle_-_the_water_balance

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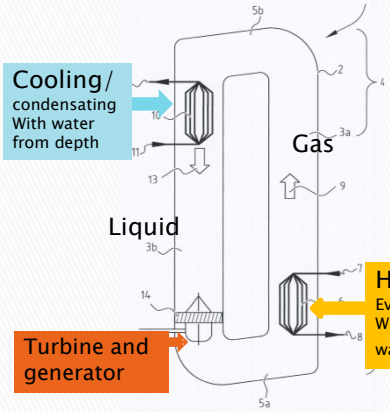
How to put a hydrological cycle in a box?



- Closed loop (two connected tubes)
- Add surface heat at the bottom, let fluïd evaporize
- Cool at the top, let fluïd condensate
- T-condens<T-evap
- Fluïd in liquid state drives turbine, which drives generator

SCHEG Cycle | Characteristics

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Possible working fluids

- Low enthalpy of evaporation/conden-sation (100-200kJ/kg; cf water: 2260 kJ/kg)
- Condensating at acceptable pressures <1Mpa) around 285°K
- Environmentally acceptable

Characteristics

- Cooling fluids:
  - **R218 (used in example)**
  - R116
  - C4F8/C4F10
- Xenon (H evap:60 kJ/kg)
- Mixture of water and ammonia (H evap 200, but affordable)

Examples

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Power and Flow for 10 MW, using R218 as working fluid

- P=Force*speed
- P=Mass*g*speed
- P=A*h*ρ*g*v
- P (max,th)=17MWe
- P (eff) = 10 Mwe (counting pump loss, conversion loss turbine, friction)
- P (water in/out)≈700MW,

Power

- A1= 1,8 m2 (∅1,5 m)
- A2= 12,5 m2 (∅ 4 m)
- h= 250 m
- ρ1= 1400 kg/m3
- ρ2= 65 kg/m3
- g=9,81
- v=2,8 m/sec
- Working fluid flow: 1: 5 m3/sec, 2:107 m3/sec
- T-evap: 292, Tcond: 285°K
- Water flow: 22 m3/sec (ΔT Heat exchanger: 8 °K)

Design parameters

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Basic Business Case

- Value per MWh: €125
- Prdctn hr/yr: 8000
- Value per MW/yr: 1 M €
- Invstmt OTEC: 5 M€/MW

- Cf.:Investment sea based windpower: 3 M€/MW

  (production: 4000 hr/yr with 180 €/MWh)

Capacity	MW		10
Production time	hr/yr		8000
Price/MWh	€/MWh	€	125
Turnover	€	€	10.000.000
Turnover OPEX	%		20,0%
Turnover OPEX	€	€	2.000.000
Available for cap cost	€	€	8.000.000
Investment	€	€	50.000.000
WACC	%		10,0%
Econ life span	yr		10
capital cost/yr	€		€ 8.100.000

WACC: Weighted Average Cost of Capital, e.g.: 30 % risk capital at 18 % and 70 % bank loan at 7 %

Per MW/year

10 MW OTEC

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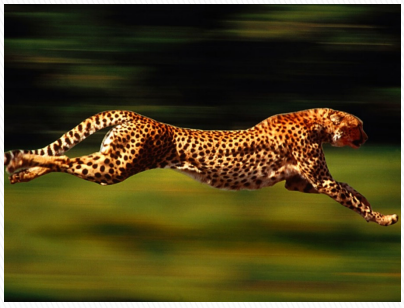
African wisdom: far and fast: time to work together



"If you want to go fast, go alone,

if you want to go far, go together"

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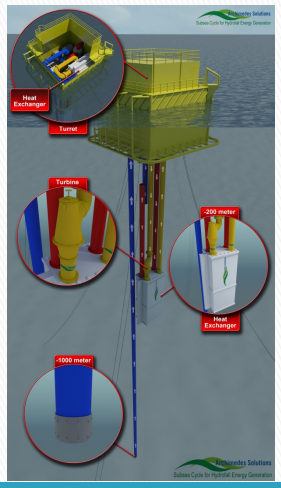
Questions?

- Thank you for your attention
- More info at www.archimedessolutions.nl
- Cooperation welcome!

Future: Affordable Sustainable Energy for coastal cities!



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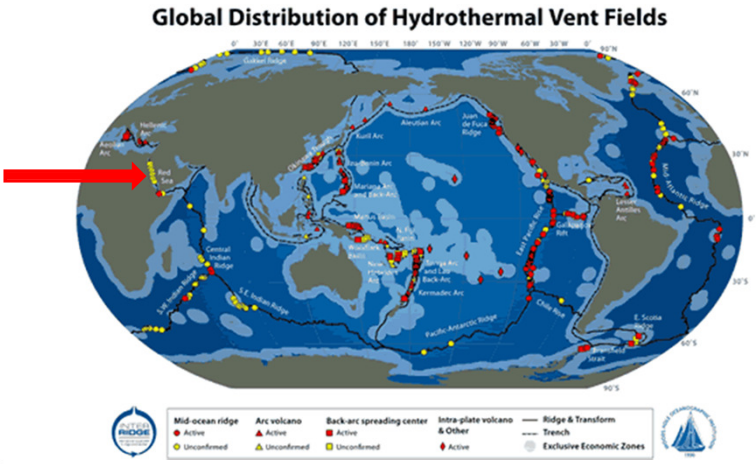
Ever thought about hot vents for North East Africa?



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