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DISTRICT ENERGY VENTURE

# MALDIVES DISTRICT COOLING

GENEVA 6 APRIL BY PÄR DALIN, PRESIDENT DEVCCO

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- **Project objectives**
- **Assessment methodology**
- **Cooling demand**
- **Technology options & Potential refrigerant, avoidance**
- **Implementation plan**
- **Financial Key Figures**
- **Barriers to overcome**
- **Conclusion and update actions**

## CONTACT

[par.dalin@devcco.se](mailto:par.dalin@devcco.se)

+46 70 617 77 21

[www.devcco.se](http://www.devcco.se)

# PROJECT OBJECTIVES

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- Originally to assess possibilities to phase out HFC/HCFC in Male' by introducing District Cooling...
- But it turned out the potential in Hulhumale' developments is quite substantial, 30 times larger, so...
- Main focus is now to come up with a plan to develop District Cooling in Hulhumale'

# MALE' & HULHUMALE'



Image © 2016 CNES / Astrium

Image © 2016 DigitalGlobe  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Hulhumale'

Male'

Google earth

# ASSESSMENT METHODOLOGY

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# COOLING DEMAND

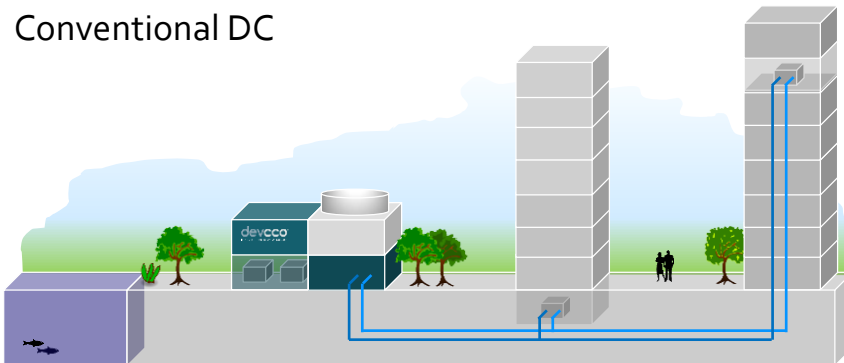
- Hulhumale' is largely an artificial island created to make room for future development of the Maldivian capital.
- The preliminary estimate of the cooling demand is 300 MW (84,000 TR).
- High end mix of residential, business, tourism and knowledge developments.



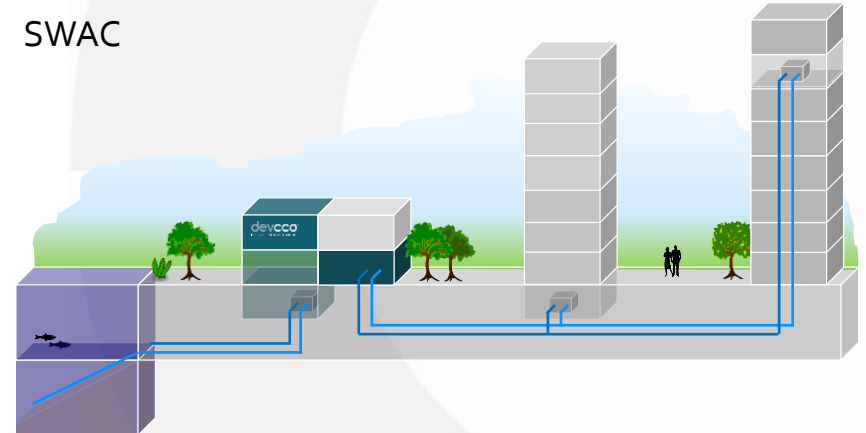
# DISTRICT COOLING TECHNOLOGY OPTIONS

- Conventional District Cooling
- Sea Water Air Conditioning
- Hybrid system

Conventional DC

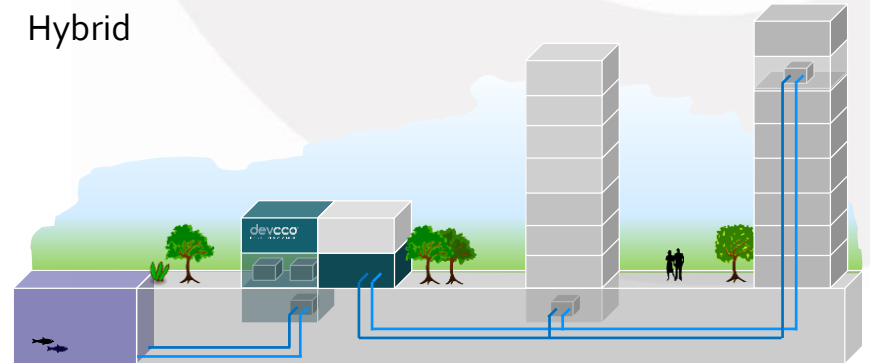


SWAC



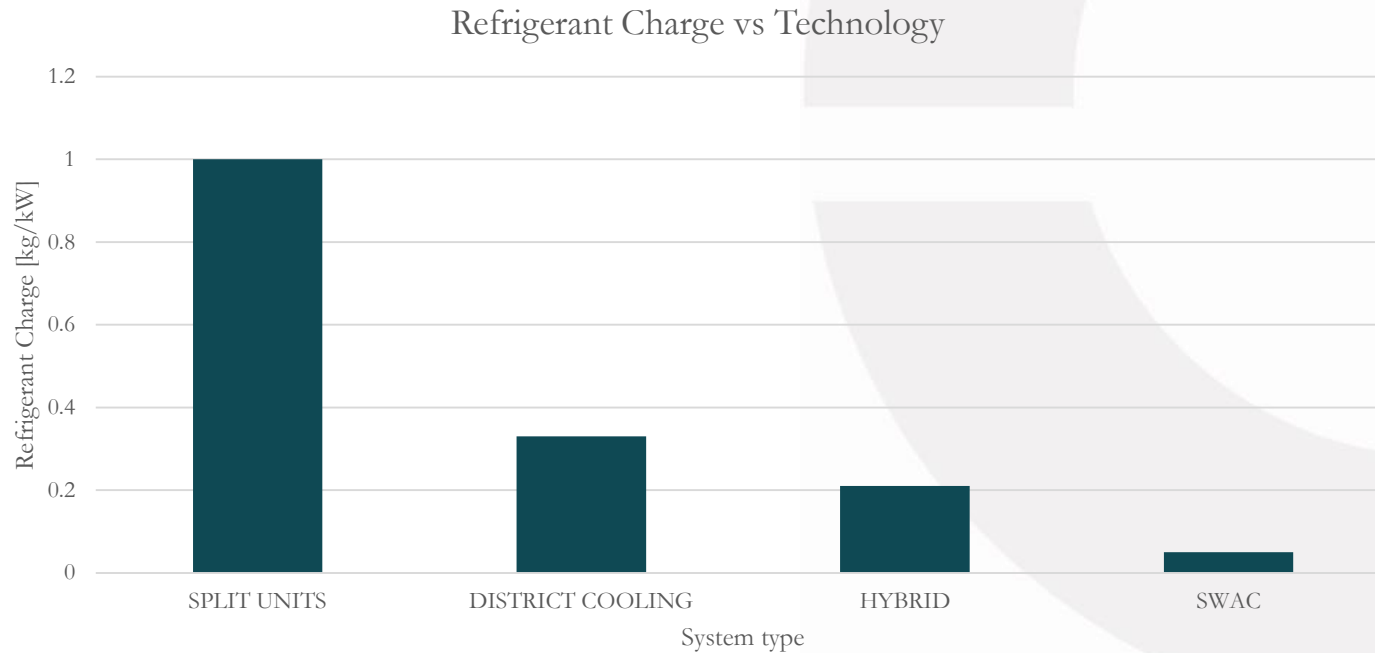
Water intake: - 800 to -1000m, 2,5km from shore line, 6-8 degree C

Hybrid



Water intake: - 200 m, 0,6km from shoreline 14-15 degree C

# POTENTIAL REFRIGERANT, AVOIDANCE

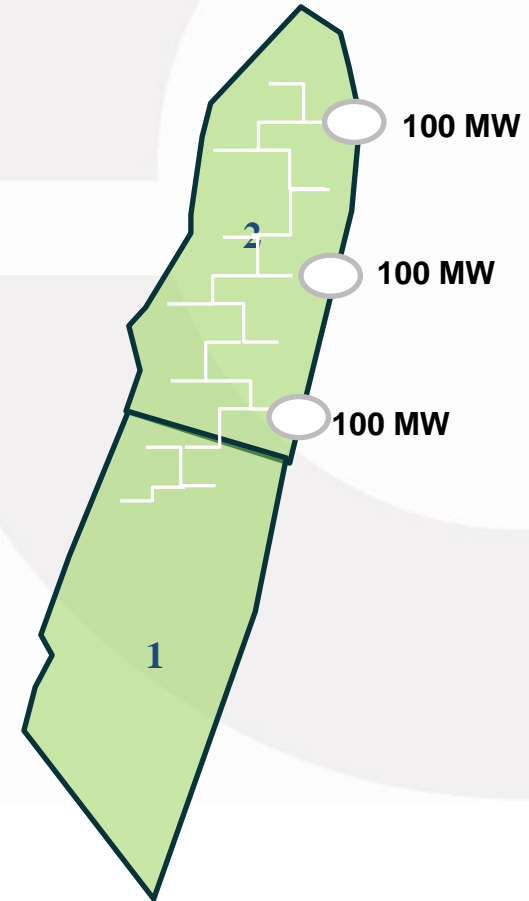


**Potential of up to 300.000 kg of refrigerant avoided for Hulhumale'**



# IMPLEMENTATION PLAN

- Due to the large demand and long development time, an approach in phases is recommended.
- With 3 separate cooling production stations, a high level of flexibility and reliability will be achieved.



# FINANCIAL KEY FIGURES, 100MW

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- **Baseline individual chillers/split-units/AC**

CAPEX (ROM): USD 48 million

OPEX (SSEER=3): USD 57 million/year

Present Value, CAPEX&OPEX (25years,6%): **USD 770 million**

- **Conventional District Cooling**

CAPEX (ROM): USD 40 million

OPEX (SSEER=5): USD 34 million/year

Present Value, CAPEX&OPEX (25years,6%): **USD 435 million**

- **SWAC**

CAPEX (ROM): USD 58 million

OPEX (SSEER=15): USD 11 million/year

Present Value, CAPEX&OPEX (25years,6%): **USD 203 million**

- **Hybrid**

CAPEX (ROM): USD 48 million

OPEX (SSEER=10): USD 34 million/year

Present Value, CAPEX&OPEX (25years,6%): **USD 265 million**

# BARRIERS TO OVERCOME

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- Building codes addressing avoidance of multi-split installations need to be implemented.
- Access to land for DC purposes is scarce but vital.
- Power supply is also vital, but actually DC will contribute with more than 40 MW less investments in power generation (and distribution) capacity.



# CONCLUSIONS AND UPDATE ACTIONS

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- The scale of the Hulhumale' development 3x100MW and project key-figures shows a sound base for project financing.
- Syndication of finance and guarantees needed
- Primary stakeholders have yet to assess their potential participation in the project
- Preferred business model and financing options & structuring are yet to be analyzed in detail.

# SOME GOVERNANCE BASICS FOR DC PROJECTS

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- Obtain long term irrevocable off-take contracts with the customers
- Ensure customers undertake to pay from affixed “commencement of service” date
- Only build capacity for contracted customers
- Build on just-in-time basis: phase plant to meet customer demand
- Freeze capex costs through contracts such as EPC and BOT
- Set off-take contracts based on “contracted” demand, not “expected” demand
- Ensure cash flows from off-take contracts are sufficient to repay debt by maturity

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# MARKET AREAS/ZONES MALE'

Zone 1: 9MW

Zone 2: 2MW

Zone3: 2-3 MW



Conventional District Cooling or hybrid system using shallow sea water as a natural source