SAND2008-3356P

Agenda

- Introductions
- Renewable energy applications in water treatment
- Libya Project
- Summary of Actions, Next Steps

Solar Energy for Water Treatment- Many Possible Options

- Concentrating Solar Distillation
- DewVaporation (Arizona State/Altela Inc.)
- Concentrated Solar with RO
- PV Powered Desalination with RO
- PV Powered Desalination with ED

Conclusions based on energy consumption

If solar thermal energy source is available:

1) Distillation processes (except VC, perhaps) make sense only using waste heat from another process (steam turbine for electric generation).
2) Mechanical vapor compression (VC) could make sense as cogeneration option on power plant

3) RO using electricity generated by CST power plant would be more efficient than dedicated solar distillation plant

4) ED may be good PV match (DC, intermittent operation)

5) Other thermal processes (FO draw solute recycle) may be good match for cogeneration with power plant.

BOR Tularosa Inland Desalination Facility: Brackish Groundwater National Desalination Research Facility (BGNDRF)

Research Mission

- Partnered with SNL
- All water treatment applications
- Coupled energy - water research
- Pilot scale validation

Proposed Project Outline

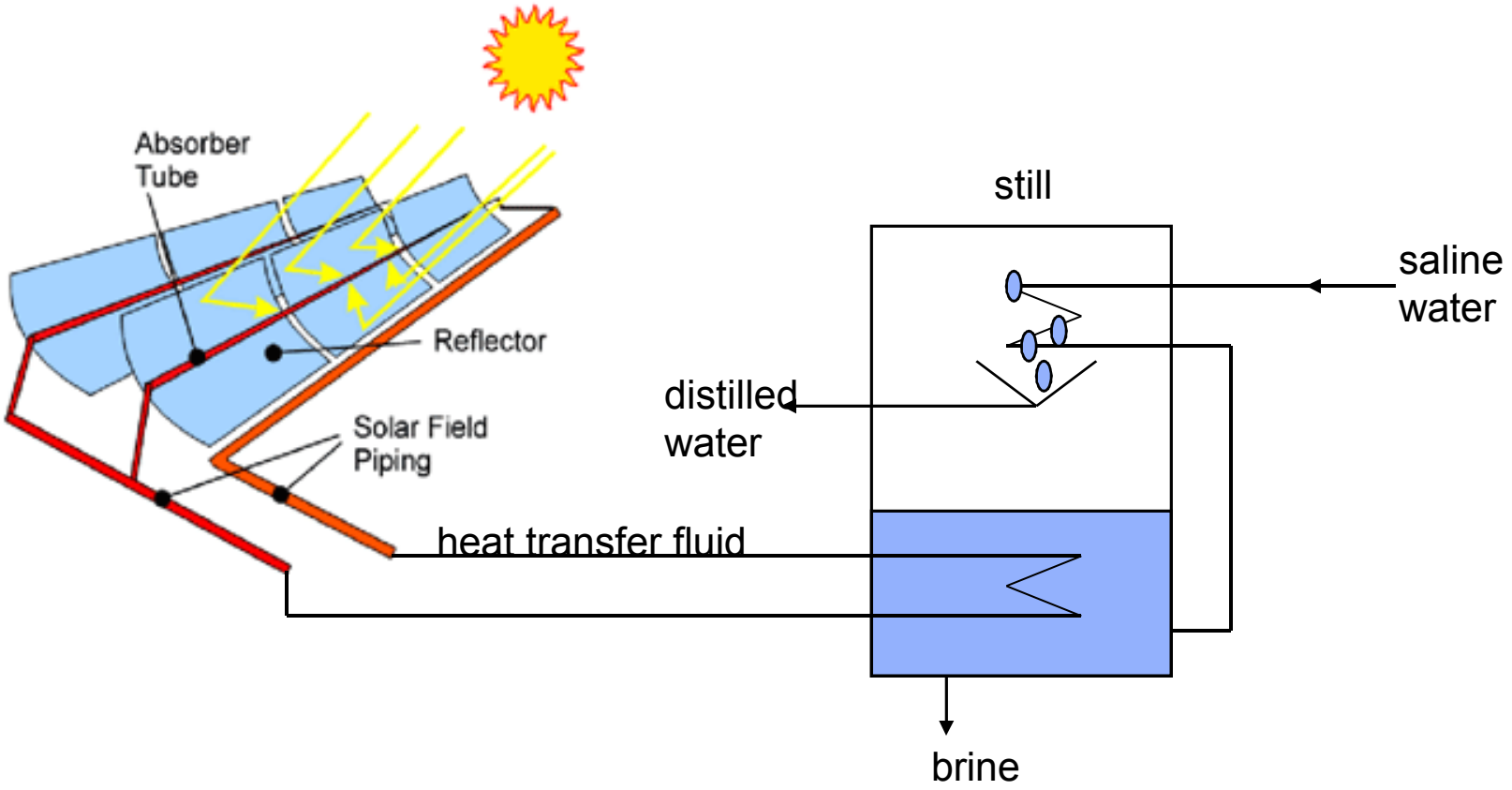
- Collect information on SOTA solar and desalination technologies
- Select best configuration(s)
  - Economics
  - Performance
  - Compatability
- Construction of Pilot Demo(s)
- Demo Testing
  - Develop testing strategy
  - Run pilot/Collect Data
- Project Completion Final Report
- Develop New R&D Projects

Considerations

- What are the big payoff applications?
- What approaches would make the biggest impact?
- What approaches make the most economic sense?
- Project Funding?

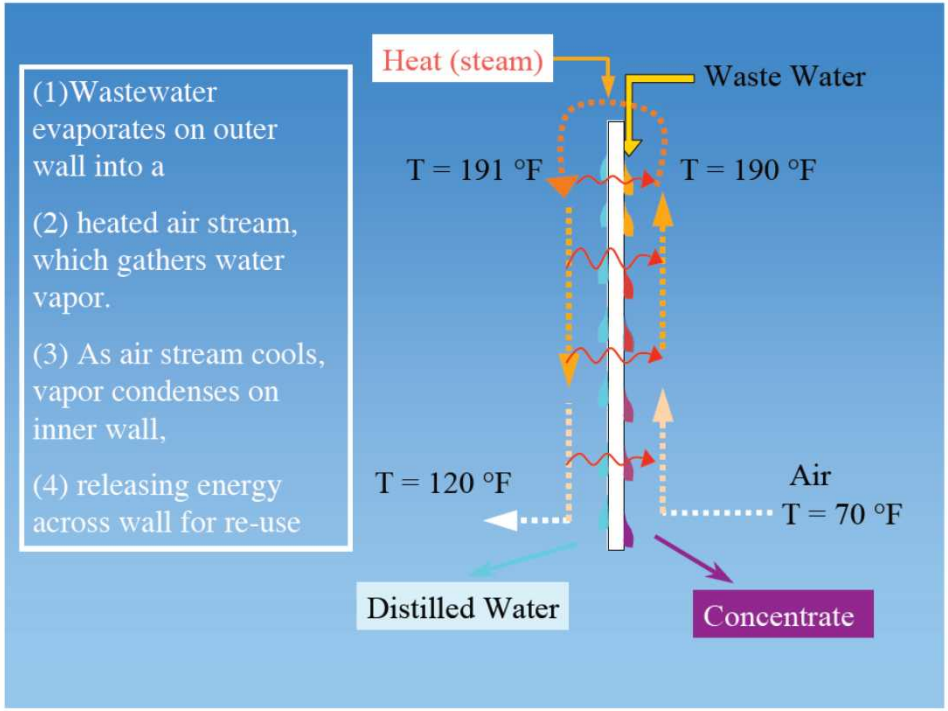
Concentrating solar distillation

- solar powered; remote site compatible
- applicable to many distillation configurations



DewVaporation system

- developed at ASU
- licensed by Altela, Inc.



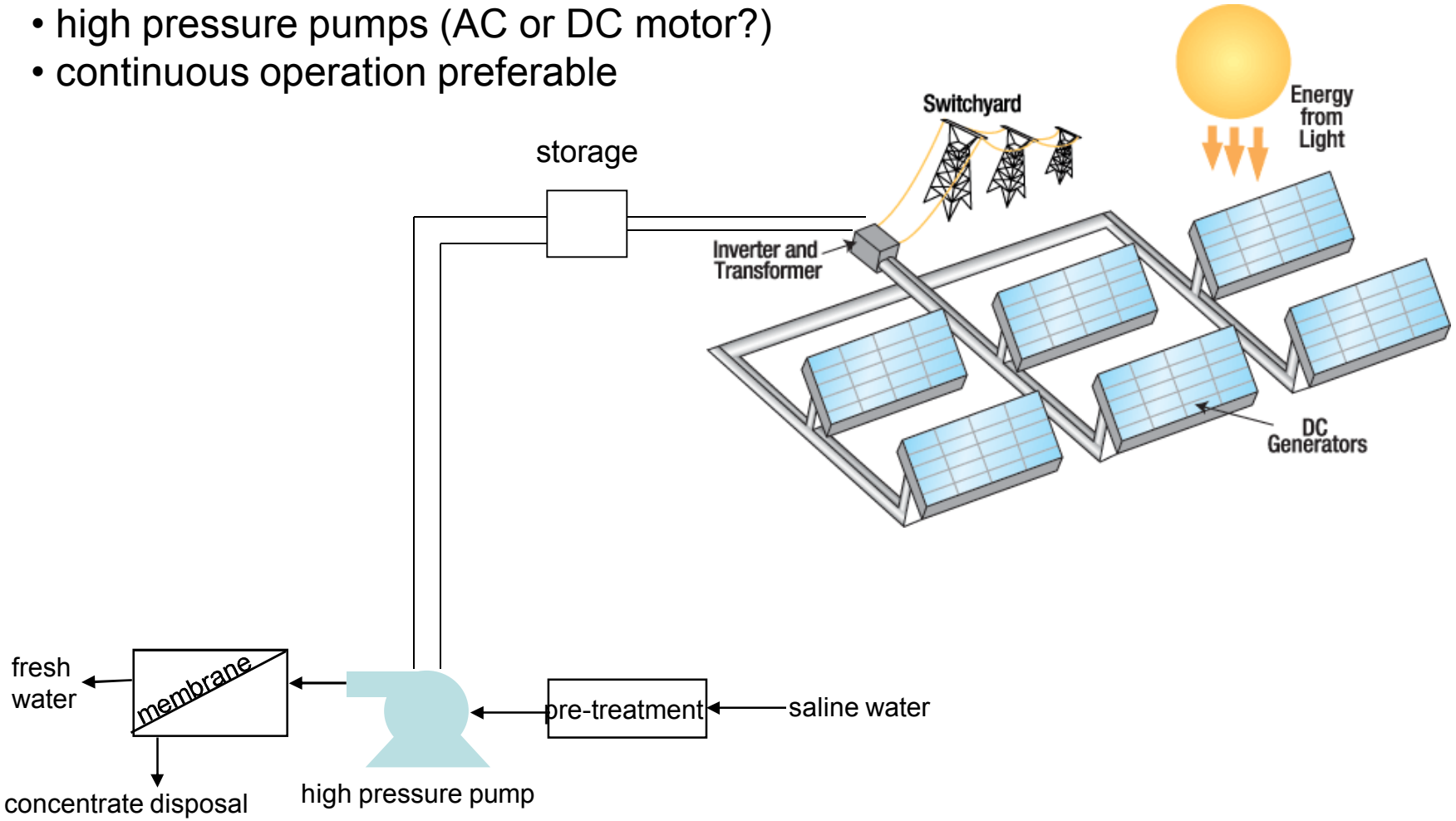
Throughput: 10 – 12 gal/hr

Thermal energy use: 2000 – 2500 BTU/hr

Electrical power use (pumps, fan, controls): ~1 kW

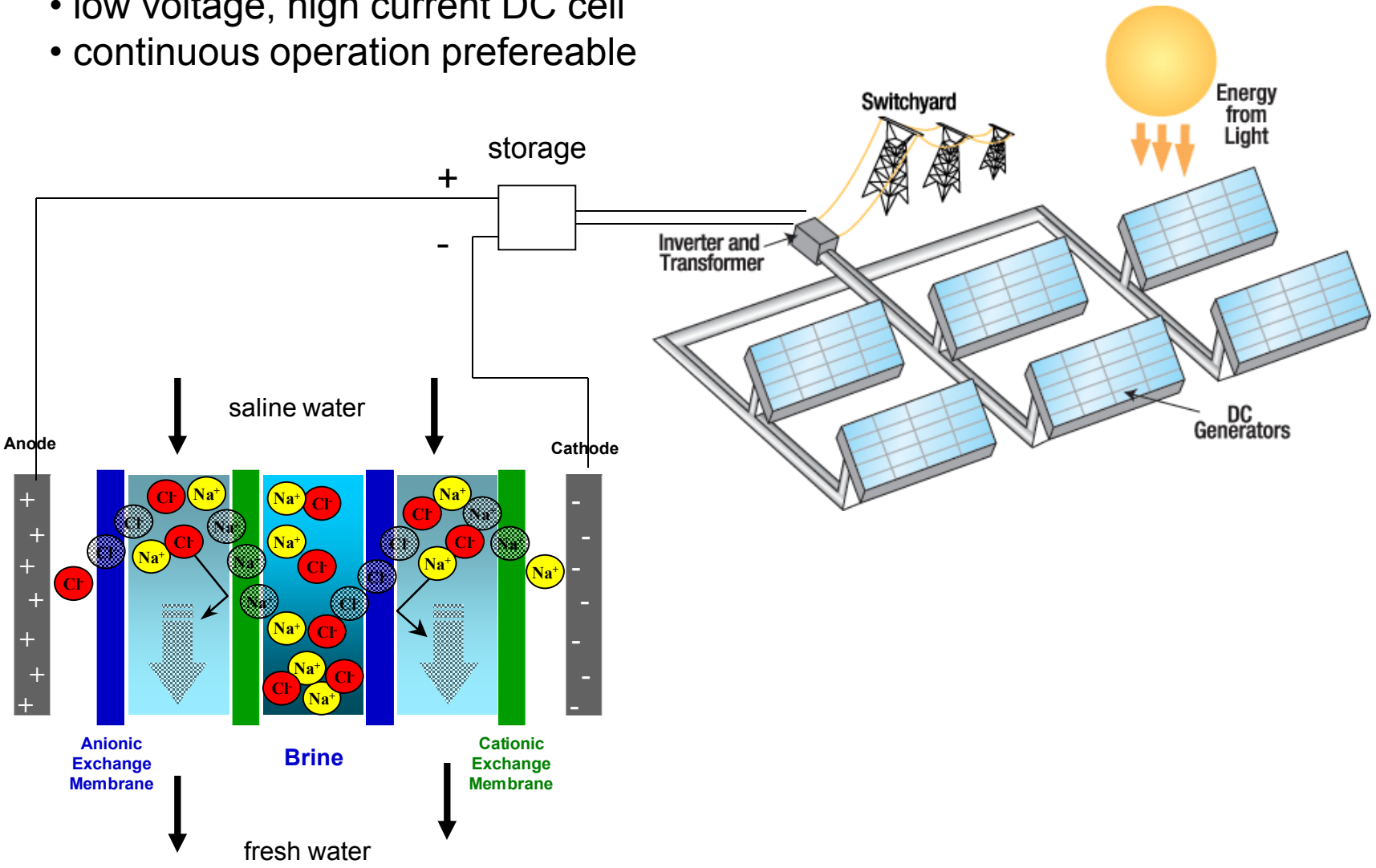
PV powered desalination systems: Reverse Osmosis

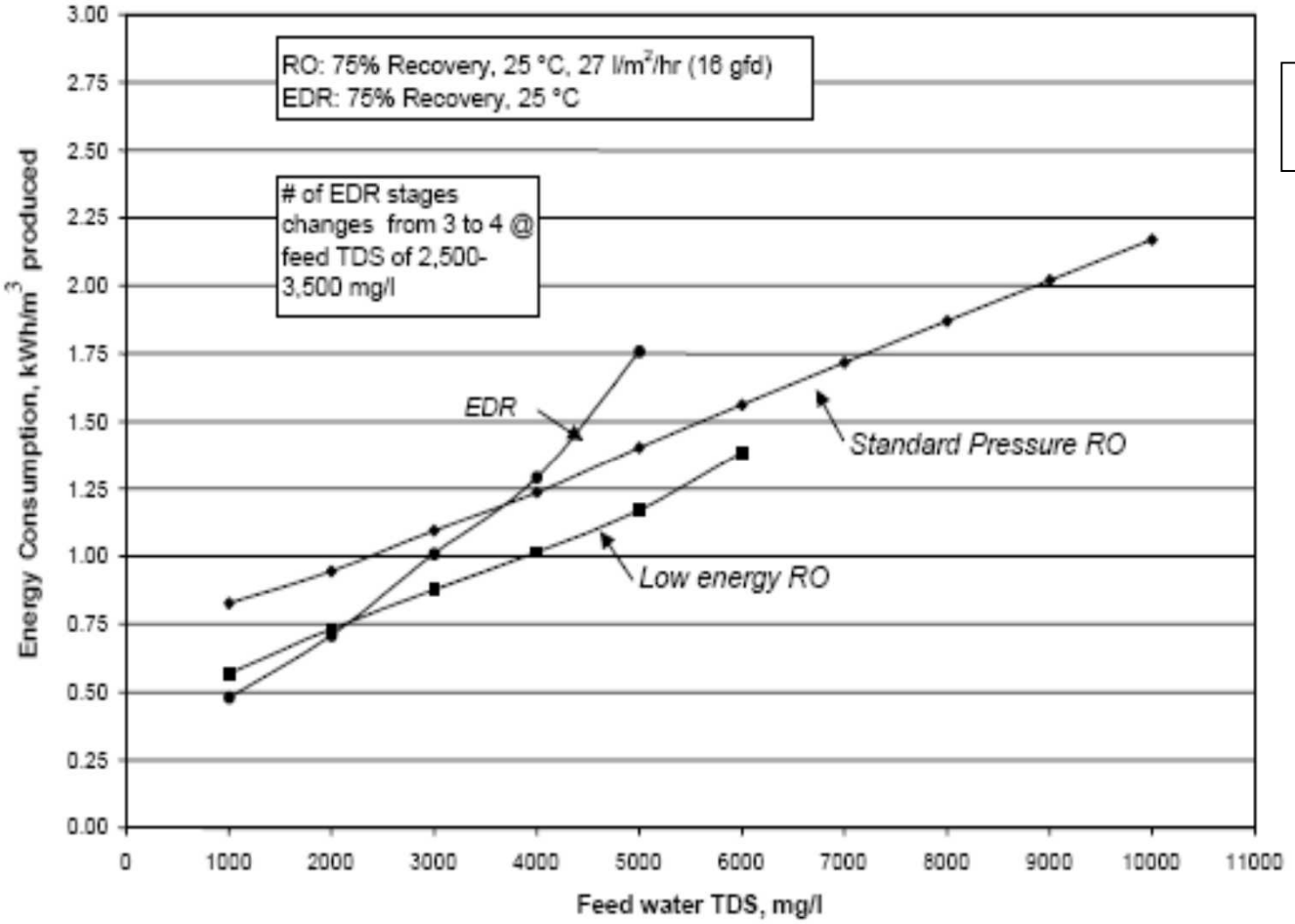
- high pressure pumps (AC or DC motor?)
- continuous operation preferable



PV powered desalination systems: Electrodialysis

- low voltage, high current DC cell
- continuous operation prefereable





Desalting Handbook for Planners, 3rd Edition (2003)

Salinity	3000 ppm	10000 ppm
1 gal/min	250 W	500 W
5 gal/min	1250 W	2500 W

Energy consumption for desalination processes (kJ/kg ~ kWh/kgal)

Reference	Seawater RO	Brackish RO	Brackish ED	MSF	MEE	VC
A	61			299		
B	15-28			95		
C	27			230		
D	23-30		4	290		
E	18-22	11		216-288		
F	11					25-43
G	15-28					29-39
H				95-252	107-132	22-29
I						14-29
J						25-36
K						26
L						37
M					95-275	
N					152	
O	14	7.2				

RO reverse osmosis
ED electrodialysis
MSF multi-stage flash dist.
MEE multi-effect dist.
VC vapor compress. dist.

Energy units are electrical for RO and ED, thermal for distillation

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