تحت رعاية معالي رئيس مجلس الوزراء المصري المهندس شريف إسماعيل
مؤتمر تحلية المياه الحادي عشر في البلدان العربية
UNDER THE PATRONAGE OF THE EGYPTIAN PRIME MINISTER ENGINEER SHERIF ISMAIL
11TH WATER DISALINATION CONFERENCE IN THE ARAB COUNTRIES
18-19 APRIL 2017 • INTERCONTINENTAL CITY STARS - CAIRO - EGYPT

A Solar-Based Thermo-Electric Saline Water Desalination Device for Drinking Needs: A Numerical Study

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بالتعاون مع
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Outlines

- Introduction
- Concept
- Application
- Results
- Conclusions
- Future Work

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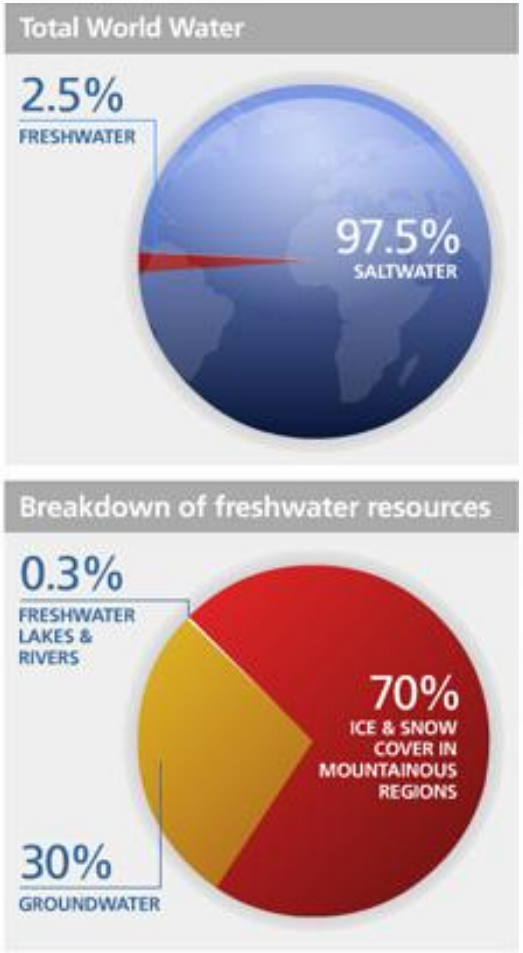
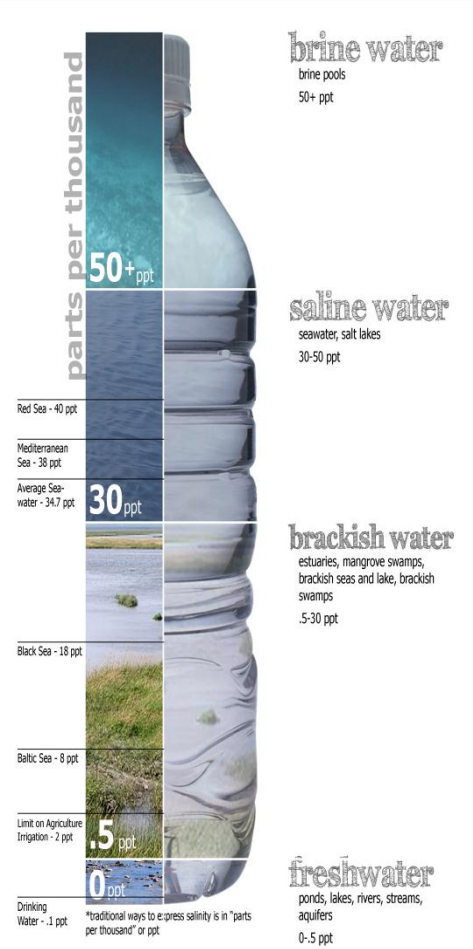
Outlines

Water Resources and Needs





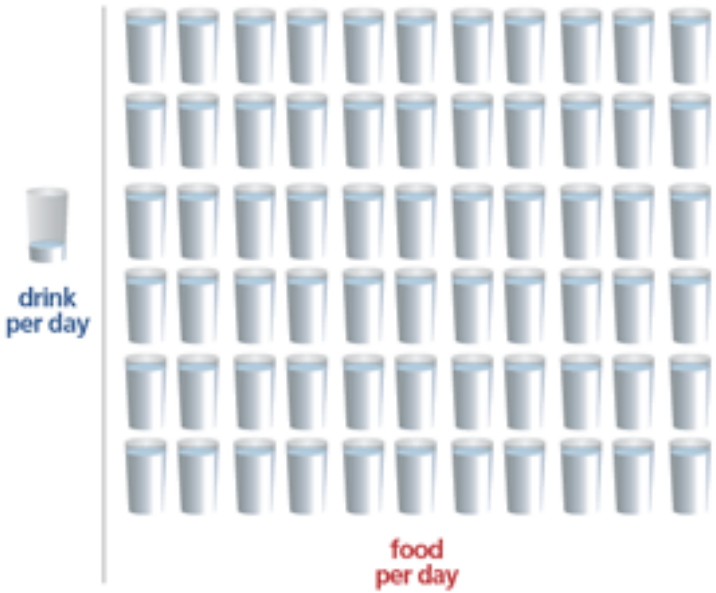
Source: http://www.fao.org

Introduction

Water Resources and Needs

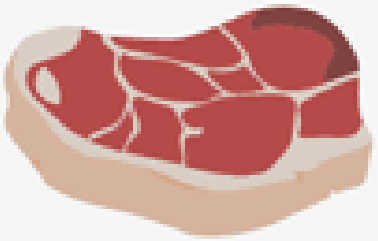
Much more water required to produce food

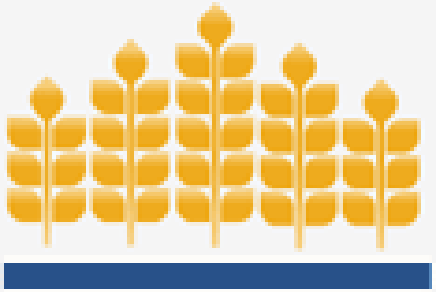
The daily drinking water requirement per person is 2-4 litres, but it takes 2,000 to 5,000 litres of water to produce one person's daily food.



Substantially more water required for meat

Producing 1 kg of **grain** requires approximately **1,500** litres of water while 1 kg of **beef** requires **15,000** litres.





Source: http://www.fao.org

Introduction

Water Resources and Needs

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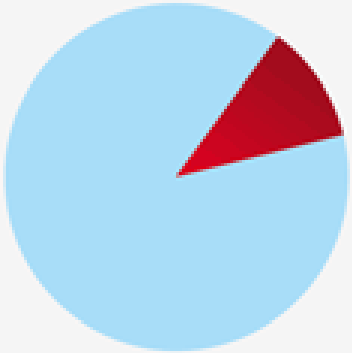
Introduction

Water Resources and Needs

Lack of access to water



11% of the global population, or **783 million people**, are still without access to water.

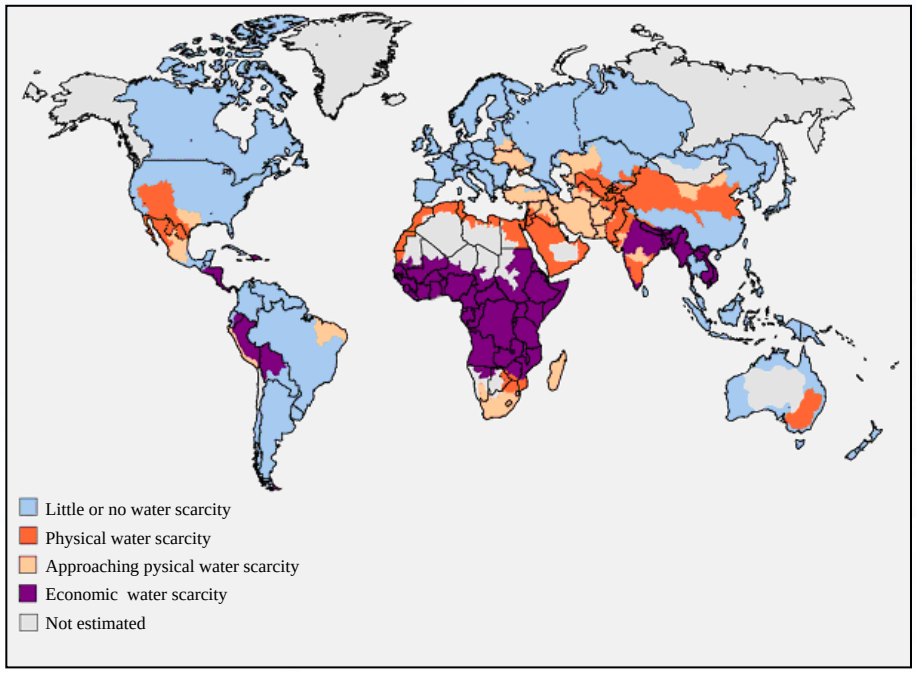
Water scarcity growth

In 2030, **47%** of world population will be living in areas of high water stress

http://www.fao.org

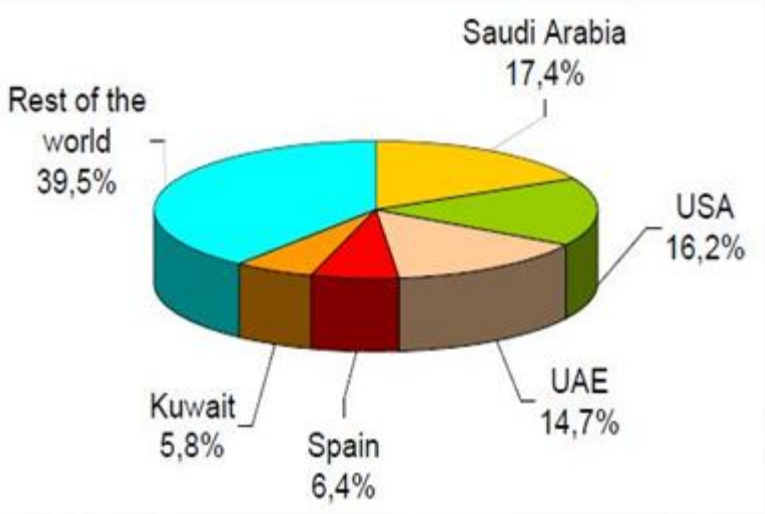
Introduction

Water Crisis in Arab Countries



Areas of physical and economic water scarcity

Source: International Water Management Institute (IWMI). Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture; Earthscan: London, UK, 2007.



Five countries (Saudi Arabia, USA, UAE, Spain and Kuwait) share more than 60% of the world production capacity of desalinated water

Source: The current state of desalination, International Desalination Association and Global Water Intelligence Desal Data service V03. 2010.

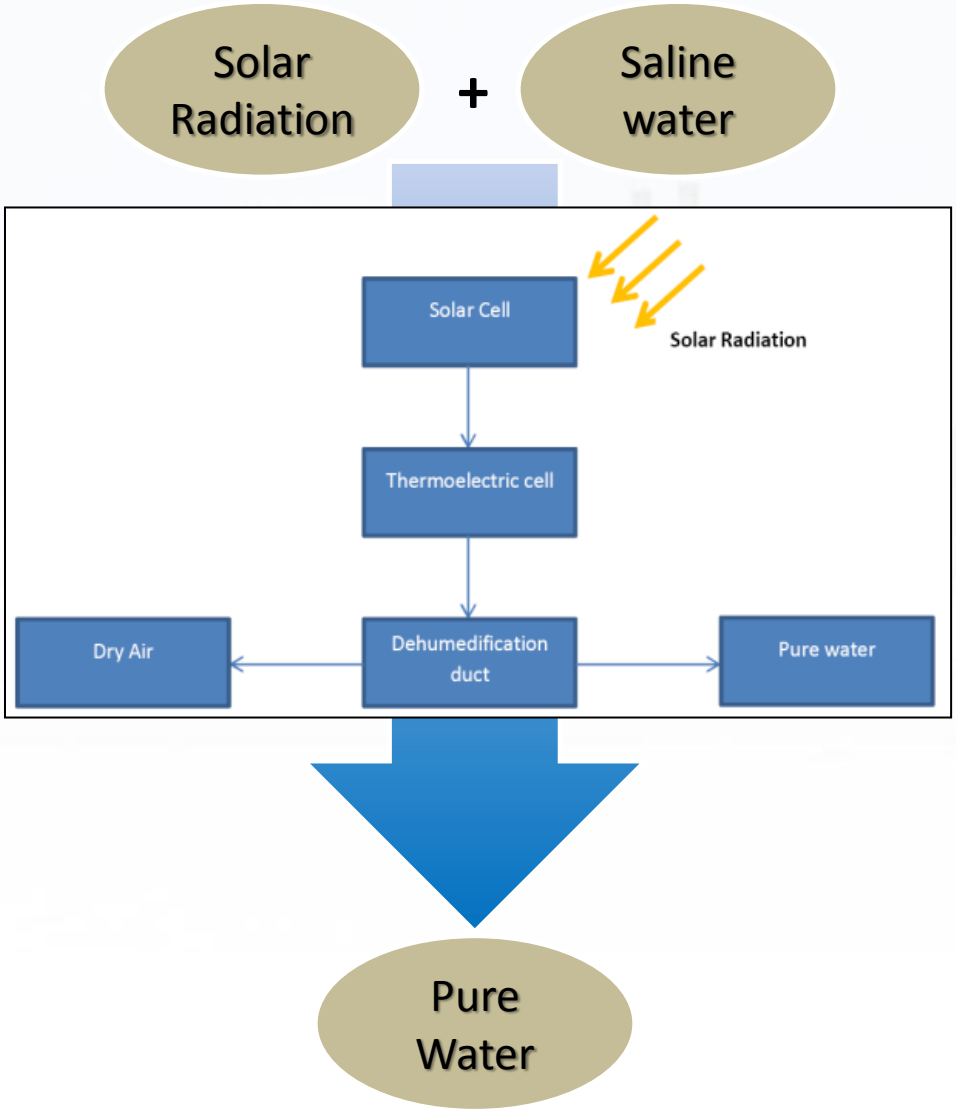
Introduction

Solar Energy in Arab Countries

Arab countries have abundant sunshine throughout the whole year; the sun in Arab countries emits about 7 kW/hr/m²/day. Since, the economical production of solar electricity requires radiation of 4-5 kW/hr/m²/day.

Introduction

Methodology



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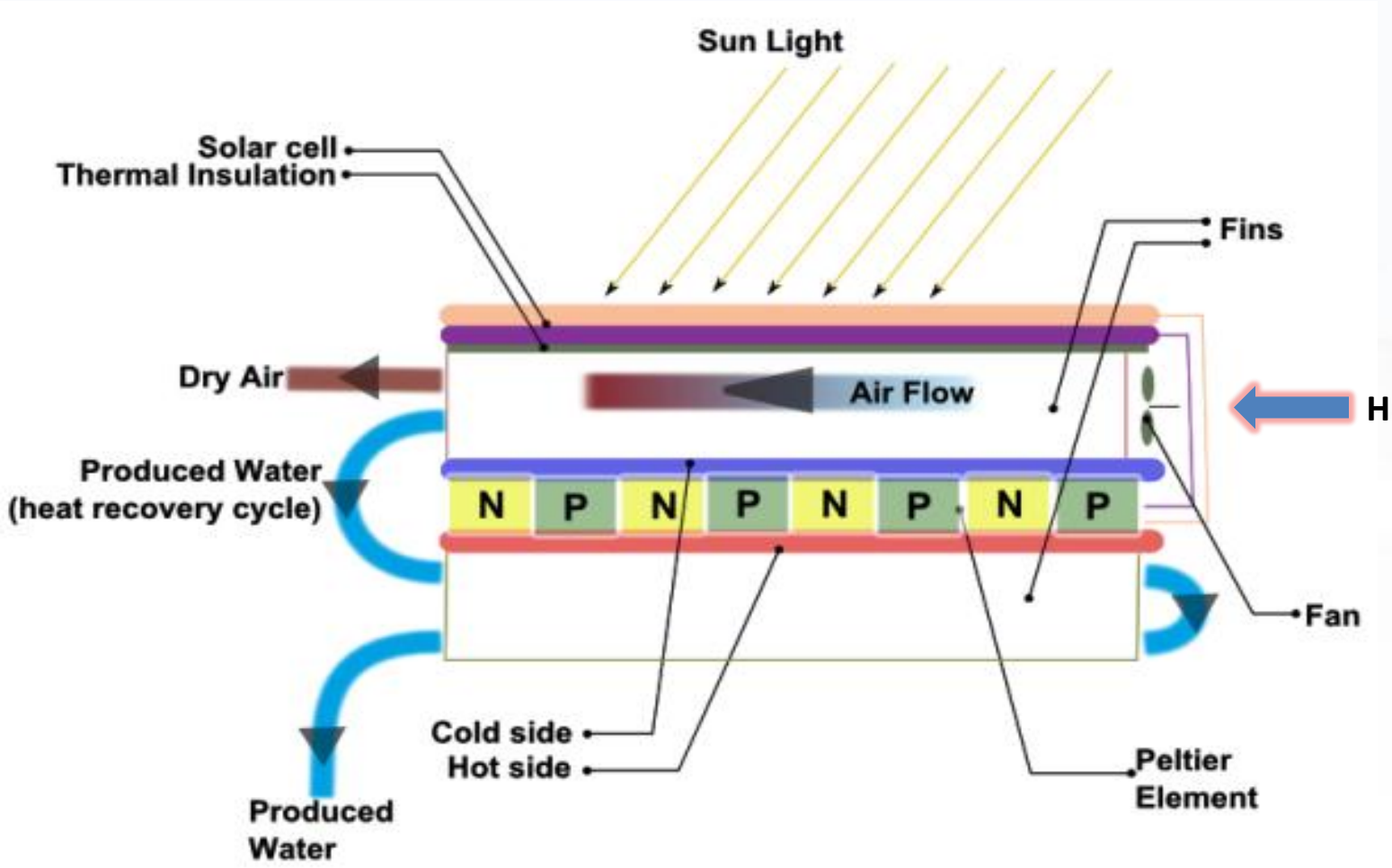
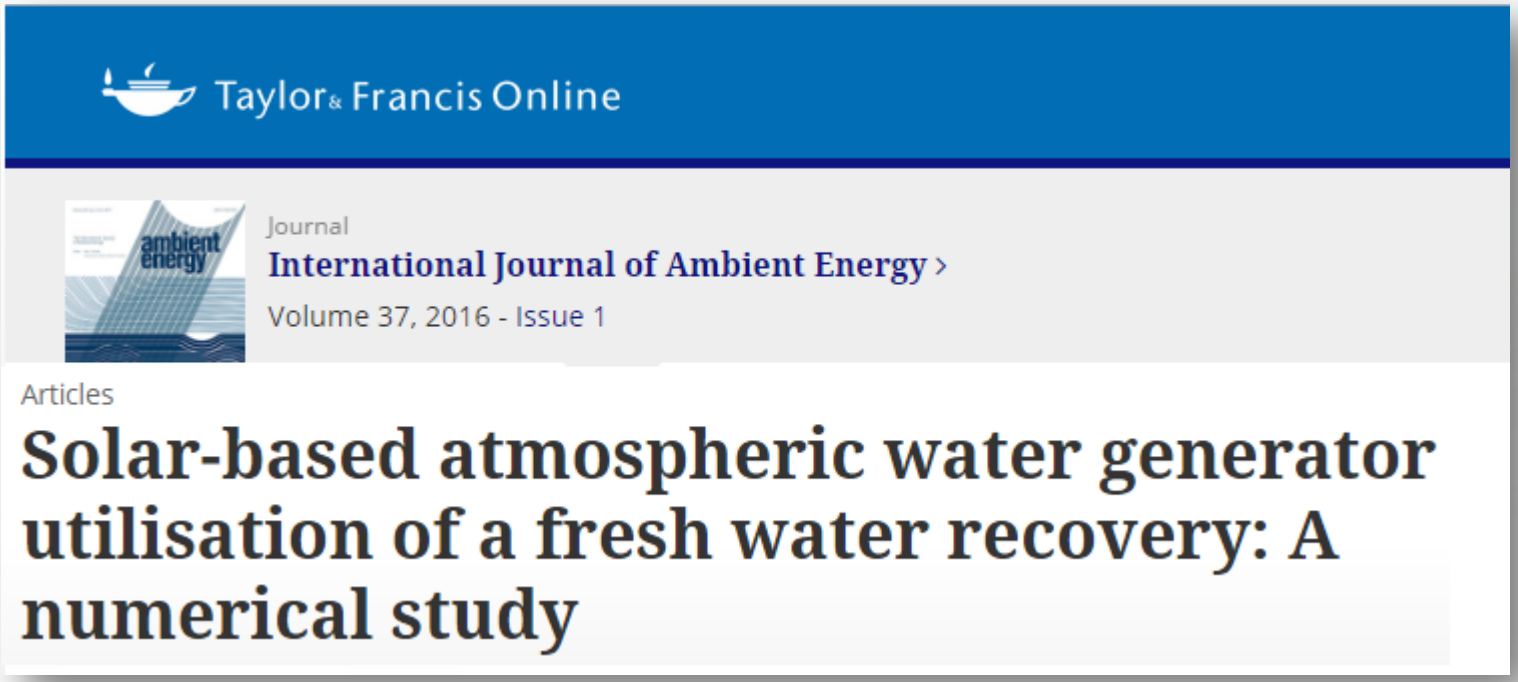
Concept

Thermo-electric Water Generator System for Wet Areas



Concept

Thermo-electric Water Generator System for Wet Areas



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Journal

International Journal of Ambient Energy ›

Volume 37, 2016 - Issue 1

Articles

Solar-based atmospheric water generator utilisation of a fresh water recovery: A numerical study

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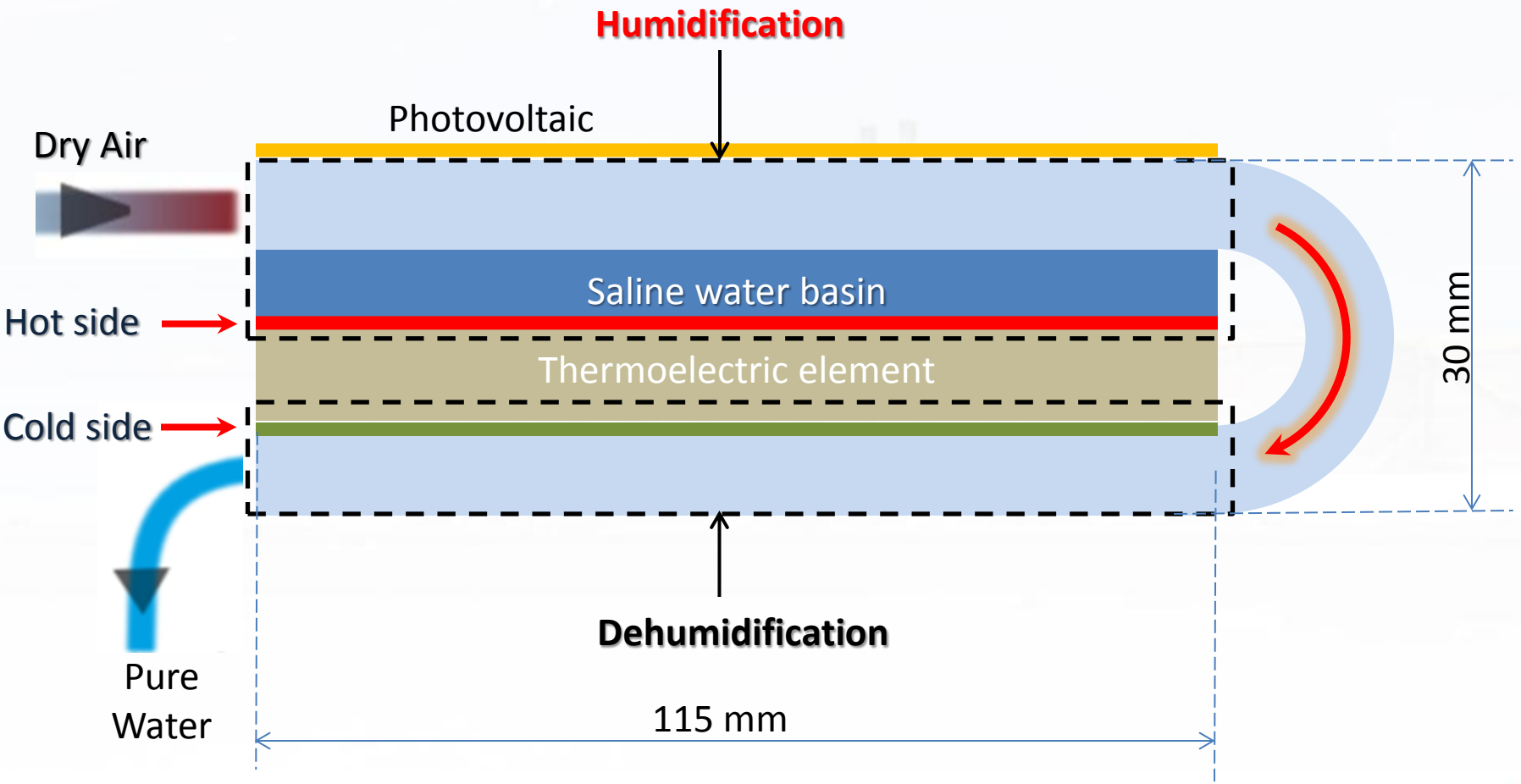
Application

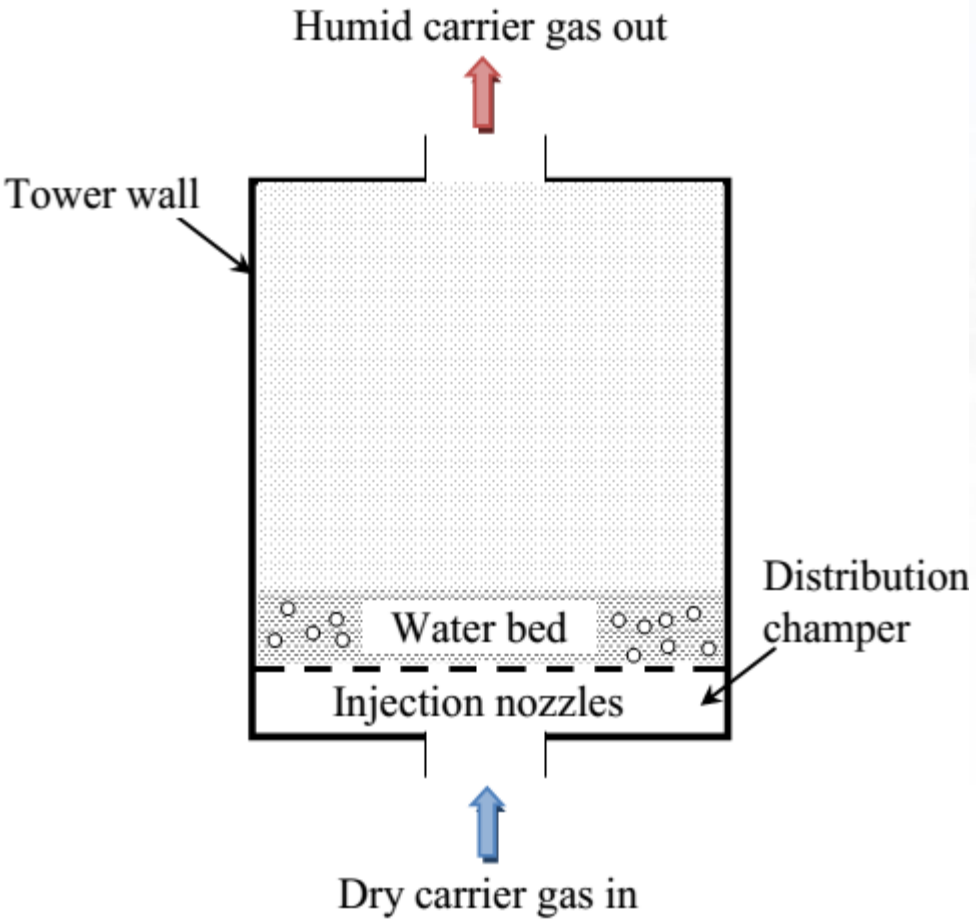
Thermo-electric Water Generator System for Dry Areas

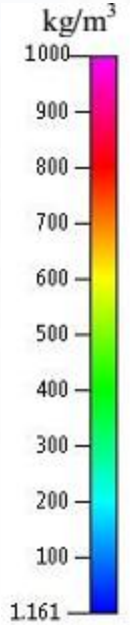


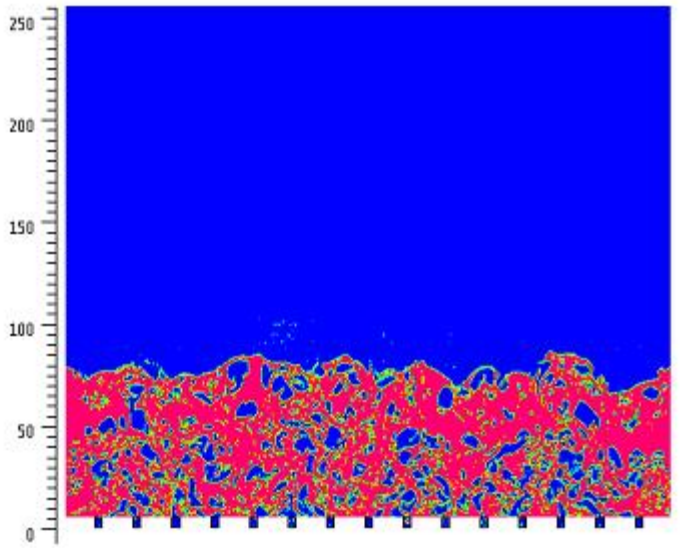
Application

Thermo-electric Water Generator System for Dry Areas

Humidifiction System







Application

Thermo-electric Water Generator System for Dry Areas

Humidifiction System

ELSEVIER

Applied Thermal Engineering

Volume 111, 25 January 2017, Pages 455–476

Research Paper

Enhancement of heat and mass transfer performance on humidification tower using injection of different carrier gases into water bed

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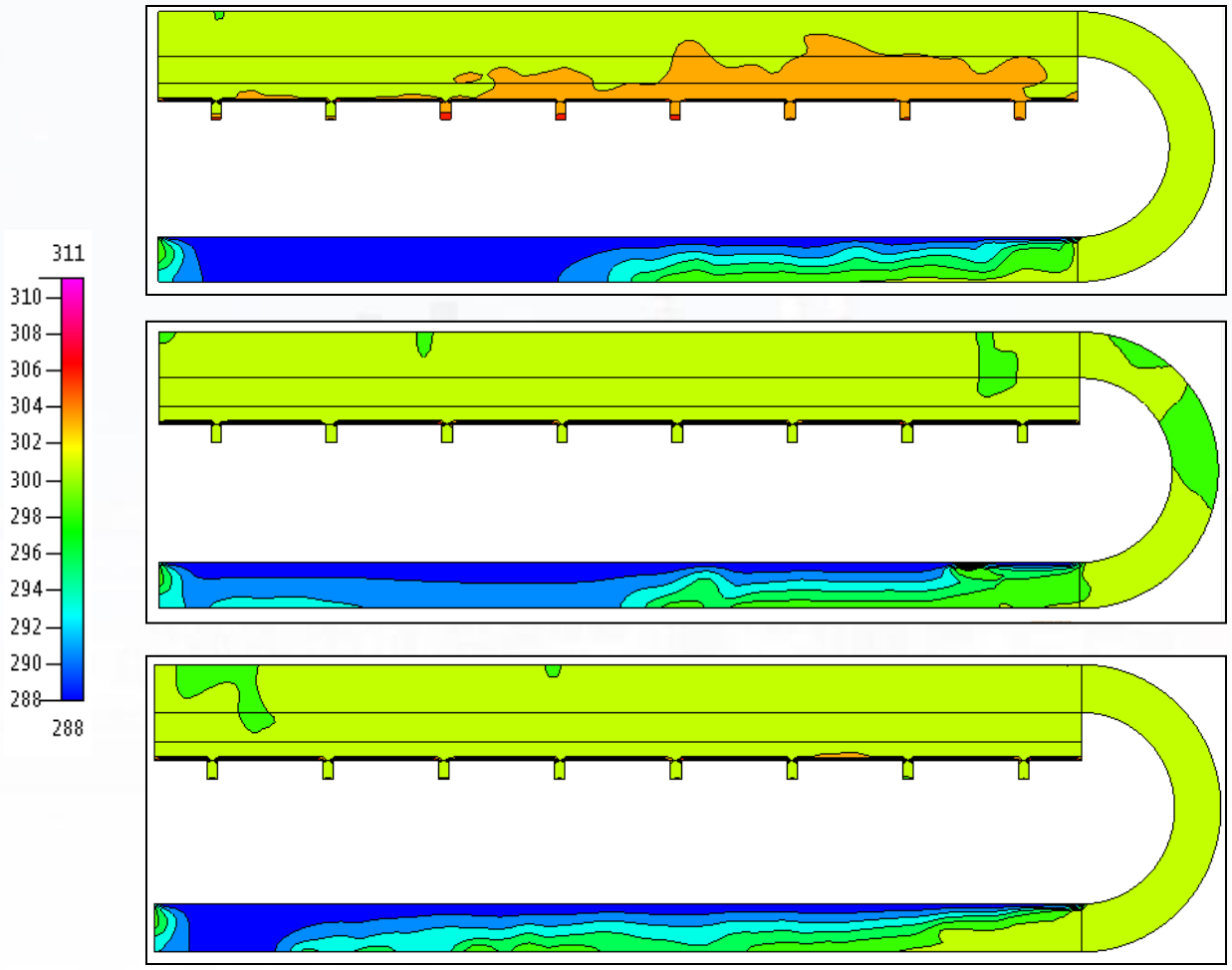
Results

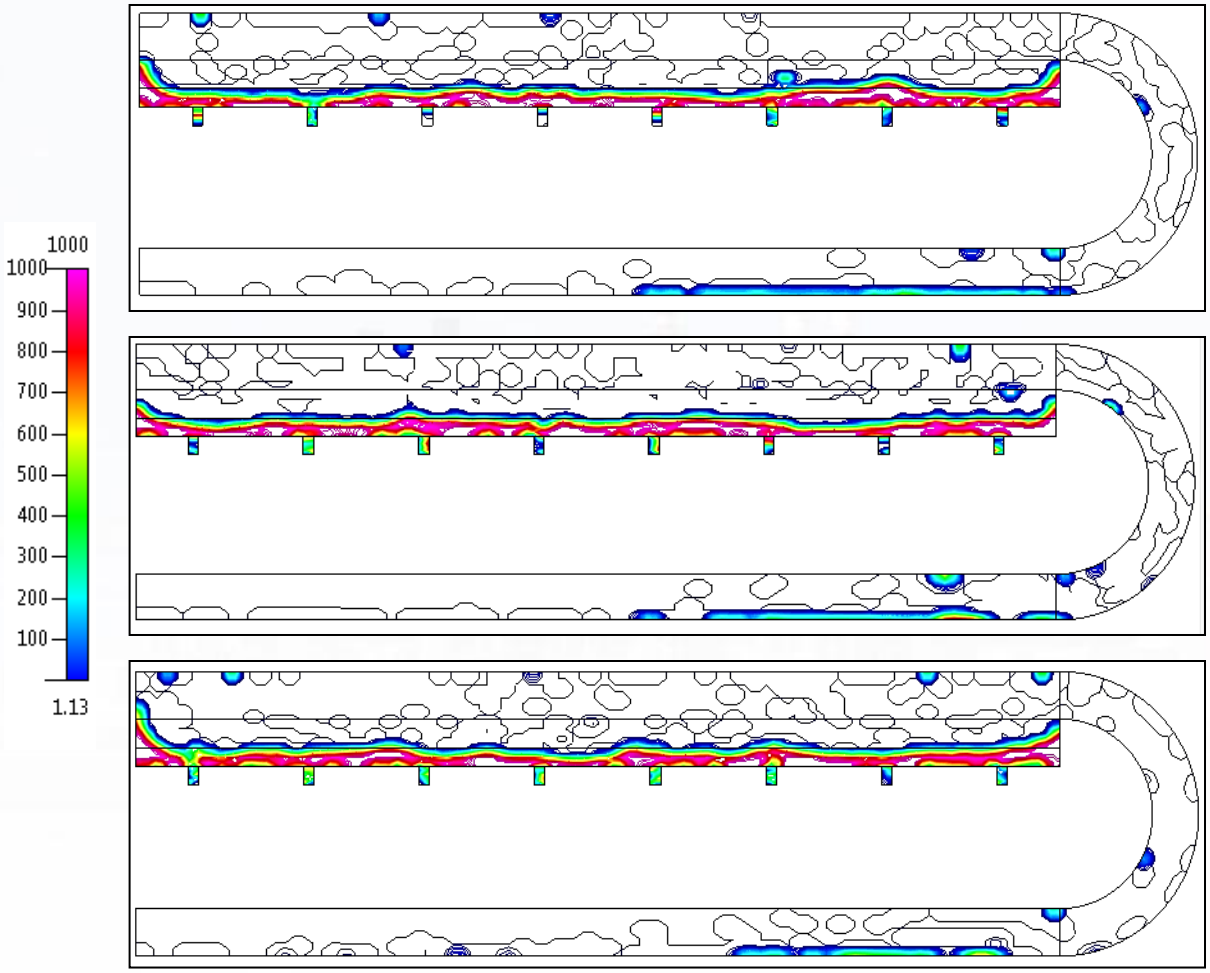
Parameter	Test case set		
	Case 1	Case 2	Case 3
Temperature of inlet air, T (°C)	35	30	27
Temperature of water bed, T (°C)	27	27	27
Air velocity, u (m/s)	0.006	0.008	0.007
Relative humidity of inlet air, Φ (%)	5	10	15
Solar radiation, S (W/m^2)	250	300	350

Results



Temperature variation of flow field at t = 1.5 sec.

Results



Case 1

Case 2

Case 3

Density distribution of flow field at t = 1.5 sec.

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Conclusions

- A new and simple design method was proposed and numerically simulated under three different climate conditions .
- The pressure drop equals around 150 Pa, for which the pumping power of air fan did not exceed 10.5 W.
- Fresh water productivity of the proposed system was up to 4.1 L/h/ m^2.
- The proposed system is simple, low-cost and low-maintenance product compared with predictive productivity.

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Future Work

- Experimental investigation under actual conditions
- Operation limits optimizations

Thanks for Your Attention!

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