

## Task 48 – Quality Assurance and Support Measures for Solar Cooling

### Subtask C: Market Support Measures

### C1: Review of Relevant International Standards, Rating and Incentive Systems

#### **Country: United States of America**

Milan, Italy – March 26, 2012

**Khalid Nagidi** 

**Energy Management Consulting Group** 





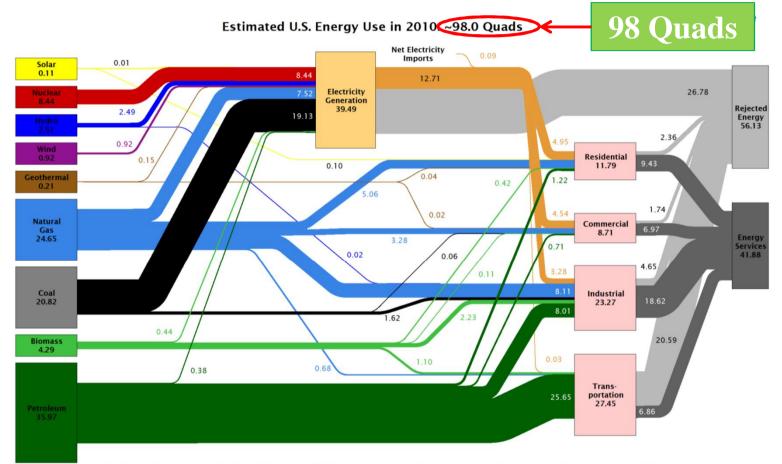
### Agenda

- Introduction
- US Solar Thermal Market
- Current Trends
- Solar Thermal Industry Rating & Certification
- Rebates & Incentives





### U.S. Energy Flow Trends – 2010



Source: LLNL 2011. Data is based on DOE/EIA-0384(2010), October 2011. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for hydro, wind, solar and geothermal in 8TU-equivalent values by assuming a typical fossil fuel plant "heat rate." (see EIA report for explanation of change to geothermal in 2010). The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

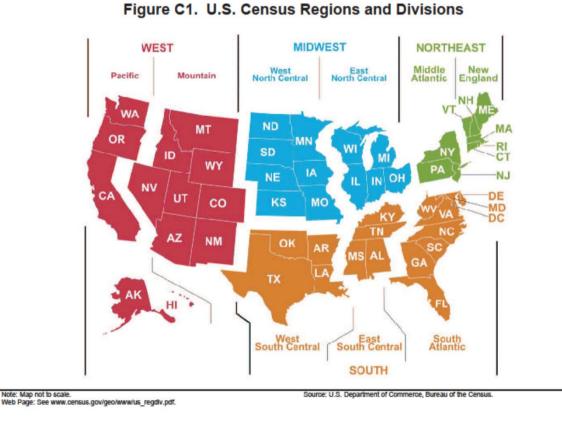
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#### Source: Lawrence Livermore National Laboratory



### **U.S. Census Regions and Divisions**

Appendix C



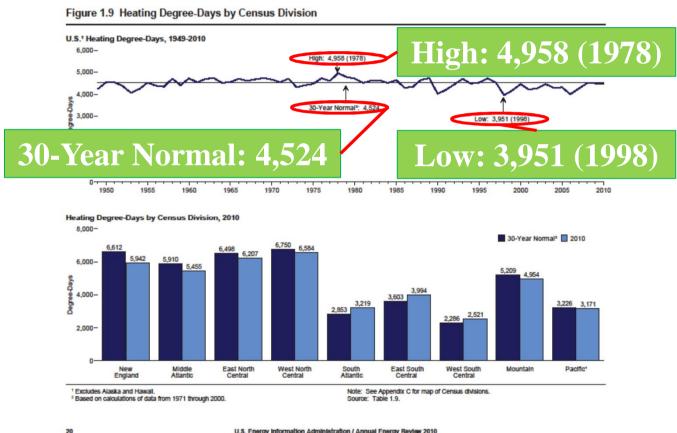
U.S. Energy Information Administration / Annual Energy Review 2010

351





### **Heating Degree-Days by Census Division**



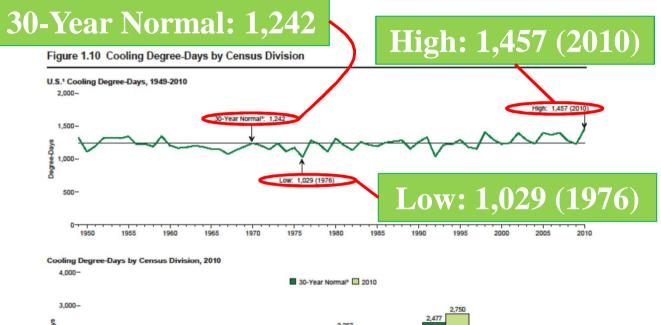
U.S. Energy Information Administration / Annual Energy Review 2010

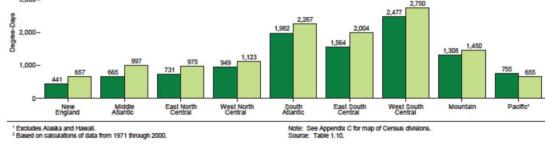




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### **Cooling Degree-Days by Census Division**





U.S. Energy Information Administration / Annual Energy Review 2010

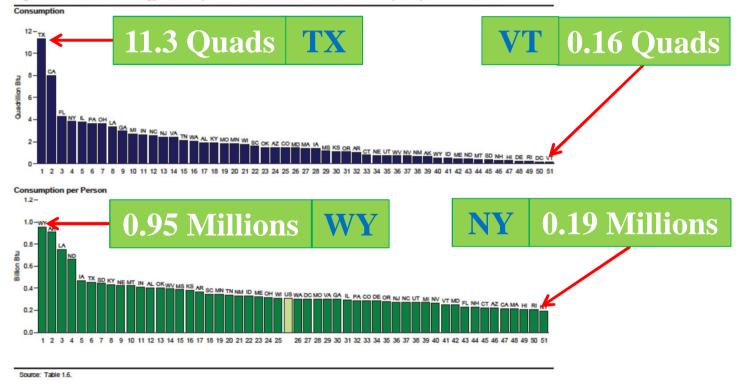




14

## **State-Level Energy Consumption Estimates and Estimated Consumption per Person in 2009**

Figure 1.6 State-Level Energy Consumption Estimates and Estimated Consumption per Person, 2009

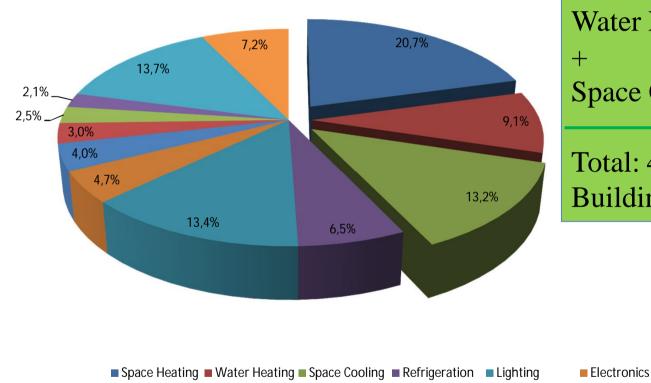


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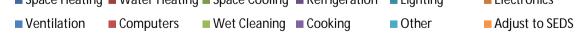
### 2010 U.S. Buildings Energy End-Use Splits



Space Heating: 20.7% + Water Heating: 9.1%

Space Cooling: 13.2%

Total: 43% of US Buildings Energy Use



#### Source: 2010 Building Energy Data Book by U.S. DOE/EERE, Table 1.1.5





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## Solar Collectors in Operation by Country at the end of 2007

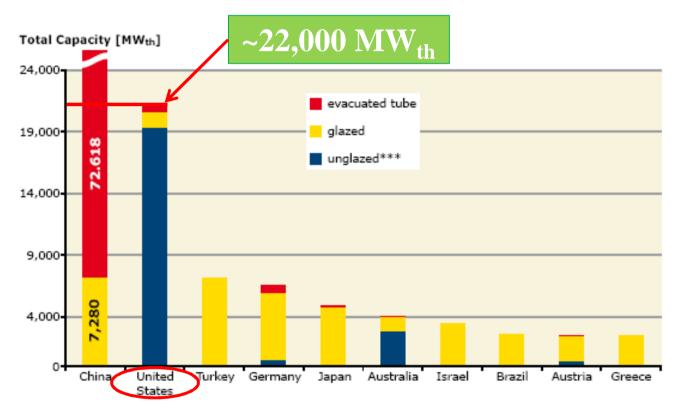


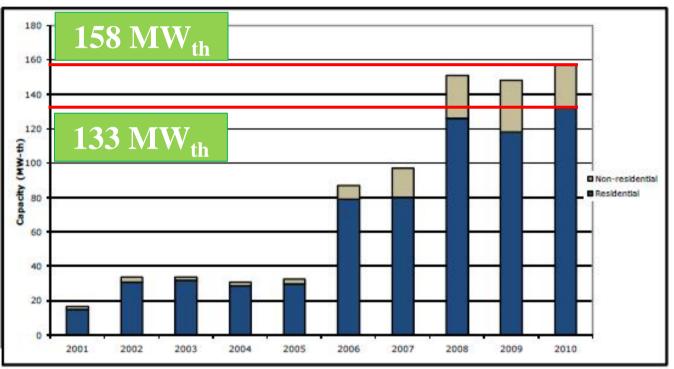
Figure 4: Total capacity in operation of water collectors of the 10 leading countries at the end of 2007

Source: Solar Heating & Cooling Worldwide – 2010 Edition





## Annual Installed U.S. Capacity for Solar Heating & Cooling (2001-2010)



Based on analysis of collector shipment data from EIA and GTM/ SEIA.

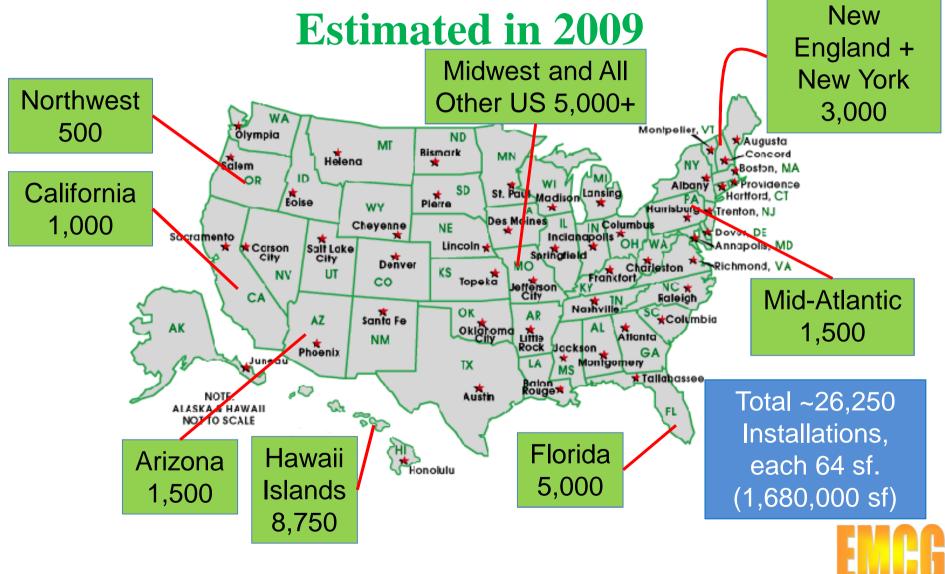
Source: U.S. Solar Market Trends 2010 / June 2011

• 84% of these installations are in the residential sector





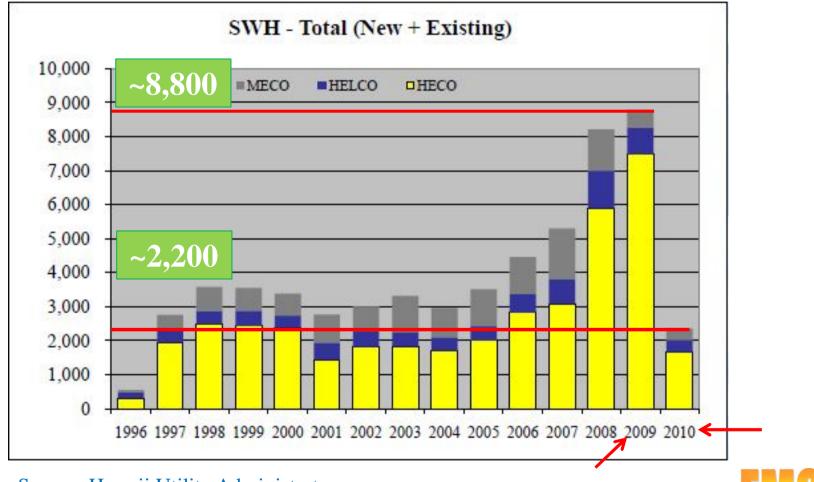
## **US Solar Thermal Installations**



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## Hawaii Residential Energy Efficient Water Heater Program (1996-Q2 2010)



Source: Hawaii Utility Administrators





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### **Current Trends**

#### **Solar Water Heating**

• Evacuated Tube Collectors are getting increased popularity

#### **Solar Swimming Pool Heating**

• More and more systems are installed with an average of  $350-400 \text{ ft}^2/\text{system}$ 

#### **Solar Space Heating**

• Interest on combined heating and hot water systems (Combi-Systems) is growing

#### **Solar Air Conditioning**

• SAC is gaining interest especially in geographical regions with generous incentives, and high energy cost





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### Solar Rating and Certification Corporation

- SRCC is a Non-profit organization established in 1980
- OG-100: Solar Collectors
- OG-300: Solar Water Heating Systems
- 110 SRCC Participants





### SRCC Certified Solar Collectors as of Q1 2012

- 946 Glazed (OG-100)
- 43 Unglazed (OG-100)
- 4 Concentrating (OG-100)
- 20 Integral Collector Storage (ISC) and Non-Separable

**Thermosiphon Collector (OG-100)** 

• 2,115 Certified Systems (OG-300)





### Typical Solar Collector Certification and Rating

CERT	OLAR COLL		CERTIFIE	SOLAR COL	LECTOR		
	SRCC		SUPPLIEF	t.	Viessmann Ma Inc. 45 Access Roa	anufacturing Co	mpany (US)
	≩ (SRCC				Warwick, RI 02		
	OG-100 CERTI	FIED	MODEL:		Vitosol 100-F,	SV1/SH1	
	CINAUSHED 1480		COLLECT	OR TYPE	Glazed Flat-Pla	ate	
	SRCC OG-	100	CERTIFIC	ATION#:	2007042A		
			Original Ce Date:	ertification	19-NOV-08		
		COLLEC	TOR THERMAL	PERFORMAN	CE RATING		
	Kilowatt-hours	Per Panel Per I	Day	Т	housands of B	TU Per Panel Pe	r Day
CATEGORY (Ti-Ta)	DAY (6.3 kWh /	MILDLY CLOUDY (4.7 kWh /	CLOUDY DAY (3.1 kWh /	CATEGORY (Ti-Ta)	CLEAR DAY (2000 Btu /	MILDLY CLOUDY (1500 Btu /	CLOUDY DAY (1000 Btu
	m <sup>2</sup> .day)	m <sup>2</sup> .day)	m <sup>2</sup> .day)		ft <sup>2</sup> .day)	ft <sup>2</sup> .day)	ft <sup>2</sup> .day)
A (-5 ℃)	11.3	8.5	5.8	A (-9 °F)	38.6	29.1	19.7
3 (5°C)	10.3	7.5	4.8	B (9°F)	35.2	25.7	16.3
C (20 °C)	8.8	6.0	3.3	C (36 °F)	30.0	20.6	11.4
D (50 °C)	5.8	3.3	1.0	D (90 °F)	19.7	11.2	3.3
E (80 °C)	3.0	0.9	0.0	E (144 °F)	10.1	3.1	0.0
E (80 °C) A- Pool He COLLECTOR	ating (Warm Clir	nate) B- Pool He	ating (Cool Clim Climate) E- /	ate) <b>C</b> - Water Air Conditioning	Heating (Warm ) J	Climate) <b>D</b> - Wate	
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E (80 °C) A- Pool He COLLECTOR	ating (Warm Clir R SPECIFICATIO ea: 2.494 ht: 42.2	nate) <b>B</b> - Pool He ONS m <sup>2</sup> kg	ating (Cool Clim Climate) E- /	ate) <b>C</b> - Water Air Conditioning	Heating (Warm )	Climate) <b>D</b> - Wate	
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IP Units:			-0.01358 (P) <sup>2</sup> /I	0.776	-4.427 W/m <sup>2</sup> .°C
IF UTITS.	η= 0.769	-0.63661 (P)/I	-0.00133 (P) <sup>2</sup> /I	0.776	-0.780 Btu/hr.ft <sup>2</sup> .°F
Incident Ang	gle Modifier [(S)=	1/cosθ - 1, 0°<θ<=60°]	Test Fluid:		Water
Κτα = 1	-0.100 (S)	-0.215 (S) <sup>2</sup>	Test Flow Rate:		
Κτα = 1	-0.32 (S)	Linear Fit	Test Flow Rate.	20.0 ml /s.m	<sup>2</sup> 0.0295 gpm/ft <sup>2</sup>

March, 2012 Certification must be renewed annually, For current status contact: SOLAR RATING & CERTIFICATION CORPORATION 400 High Point Drive, Suite 400 • Cocoa, Florida 32926 • (321) 213-6037 • Fax (321) 821-0910

	DLAR COLL		CERTIFIED	D SOLAR COL	LECTOR		
CERTIF	FICATION A	ND RATING					
	C & CERTIFICATION		SUPPLIER		Viessmann Ma	anufacturing Co	mpany (US)
	A ANDA		COTTELEN		Inc.		inpuny (oo)
	🖹 (SRCC	ATION			45 Access Roa Warwick, RI 02		
	OG-100 CERTIF	IED	MODEL:		Vitosol 300-T, S		
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CATEGORY	CLEAR	MILDLY		CATEGORY		MILDLY	
(Ti-Ta)	DAY	CLOUDY	DAY	(Ti-Ta)	DAY	CLOUDY	DAY
	(6.3 kWh / m <sup>2</sup> .day)	(4.7 kWh / m <sup>2</sup> .day)	(3.1 kWh / m <sup>2</sup> .day)		(2000 Btu / ft <sup>2</sup> .day)	(1500 Btu / ft <sup>2</sup> .day)	(1000 Btu / ft <sup>2</sup> .day)
A (-5 °C)	12.7	9.5	6.4	A (-9°F)	43.2	32.5	21.9
B (5°C)	12.7	9.1	6.0	B (9°F)	41.7	31.1	20.4
C (20 °C)	11.5	8.4	5.3	C (36 °F)	39.3	28.7	18.0
	10.1	7.0	3.9	D (90 °F)	34.6	24.0	13.5
D (50 °C)	10.1	7.0	3.9				
E (80 °C) A- Pool Heat	8.6	5.5 nate) <b>B</b> - Pool He	2.7 eating (Cool Clim	E (144 °F) ate) C- Water Air Conditioning	29.5 Heating (Warm (	18.9 Climate) <b>D</b> - Wate	9.1 r Heating (Coo
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March, 2012 Certification must be renewed annually, For current status contact: SOLAR RATING & CERTIFICATION CORPORATION 400 High Point Drive, Suite 400 € Cocoa, Florida 32926 € (321) 213-6037 € Fax (321) {





## Laboratories Offering SRCC Accredited Testing Programs in US as of Q1 2012

#### 1. Atlas Weathering Services Group

45601 N. 47th Avenue Phoenix, Arizona 85087

Accreditation Date: May 14, 2010 SRCC Test Program Accredited to Perform:

Qualification Tests (Standard 100)
Glazed Liquid-heating Collector Efficiency (Standard 100)

2. Florida Solar Energy Center 1679 Clearlake Road Cocoa, FL 32922-5703

> Accreditation Date: October 1980 SRCC Test Program Accredited to Perform:

- Qualification Tests (Standard 100)
- Glazed Liquid-heating Collector Efficiency (Standard 100)
- Unglazed Liquid-heating Collector Efficiency (Standard 100)
- ICS and Non-separable Thermosiphon Systems (SRCC TM-1)





## Laboratories Offering SRCC Accredited Testing Programs in US as of Q1 of 2012 (Cont.)

3. Pacific Energy Testing, LLC

3517 Edison Way, Suite A Menlo Park, CA 94025

#### Accreditation Date: January 31, 2010 SRCC Test Program Accredited to Perform:

- Qualification Tests (Standard 100)
- Glazed Liquid-heating Collector Efficiency (Standard 100)
- Unglazed Liquid-heating Collector Efficiency (Standard 100)
- Glazed Air-heating Collector Efficiency (ASHRAE 93)
- ICS and Non-separable Thermosiphon Systems (SRCC TM-1)

4. TUV Rheinland PTL, LLC

2210 South Roosevelt Street Tempe, AZ 85282

Accreditation Date: March 1, 2010 SRCC Test Program Accredited to Perform:

- Qualification Tests (Standard 100)
- Glazed Liquid-heating Collector Efficiency (Standard 100)
- Unglazed Liquid-heating Collector Efficiency (Standard 100)





### Agenda

- Introduction
- US Solar Thermal Market
- Current Trends
- Solar Thermal Industry Rating & Certification
- Rebates & Incentives





## Database for State Incentives for Renewables & Efficiency (DSIRE)



Source: http://www.dsireusa.org/





## California Solar Initiative – Solar Water Heating Rebate Program

- Solar equipment must be SRCC certified
- \$12.82 per estimated therm displaced of natural gas
- \$0.37 per estimated kWh displaced of electricity

Maximum Incentives:

- Single-family residential systems that displace natural gas: \$1,875
- Single-family residential systems that displace electricity: \$1,250
- Commercial and multifamily residential systems that displace natural gas: \$500,000
- Commercial and multifamily residential systems that displace electricity: \$250,000



## New York - LIPA Residential Solar Water Heating Rebate Program

- Systems must be new; collectors must be SRCC OG-100 certified
- \$20 per kBTU (based on SRCC collector rating)

#### Maximum Incentives:

• \$1,500 or 50% of installed cost

#### Installation Requirements:

• Customer must have an existing electric water heater; system orientation must be south, southeast, or southwest; system must be owned by the customer (i.e., leased systems are not eligible)





## Hawaii Energy - Solar Water Heater Rebate Program

- Equipment must be SRCC OG-100 certified.
- Residential: \$750.
- Commercial: \$50 per 5,000 Btu/hr derated capacity.





## Oregon Energy Trust - Solar Water Heating Buy-Down Program

• Systems must be new. Expansions to existing solar systems are not eligible. System must be listed as eligible by Energy Trust and must be SRCC-certified.

- Systems must be installed by a qualified Energy Trust solar contractor.
- \$1,500 for residential systems; 35% of system cost for commercial.





## Florida Beaches Energy Services - Solar Water Heating Rebate Program

• Solar Water Heater Rebate: \$500

Equipment Requirement:

- Must be Florida Solar Energy Center (FSEC) certified
- All system components must be new
- Systems must be guaranteed against freeze damage
- Solar pool heating systems ineligible

Installation Requirements:

- Newly constructed homes are not eligible for rebate
- Systems must be installed by a licensed Florida contractor according to manufacturer specifications
- System must be at least 80% shade free
- Systems must be installed prior to the issuance of a rebate





# Thank you!

### Khalid Nagidi, EMCG

khalid.nagidi@energymcg.com

