

# Behavior, Energy & Climate Change Conference

## International Perspectives on Behavior Policy:

### *A Tale of Two Countries: Influencing Energy Use Behavior in Non-US Markets*

**Joseph Lopes, Gomathi Sadhasivan, Luisa Freeman**

**DNV GL**

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# A Tale of Two Countries

## Barbados & Dubai

## Two DSM planning projects

### ■ Barbados

- Client: **Utility**
- Identify potential for energy use behavior change **due to utility incentive programs**
- Consumer and business surveys to identify existing end uses; behaviors re: usage and measure potential
- Result - Design DSM portfolio to address most cost effective and achievable opportunities

### ■ Dubai

- Client: **Regulator**
- Identify potential for energy use behavior change **due to building regulations**
- Consumer surveys to identify awareness, behaviors regarding purchase/rent decisions, potential impacts of alternative policies
- Result – Design building regulations related to real estate transactions, usage data, benchmarking and energy efficiency

***How are they alike?*** Neither country has pursued DSM, very little customer information, limited internal analytical capability for DSM, strong cultures of stakeholder engagement in planning process

# A study in contrasts

## BARBADOS

- Area: 166 sq. miles
- Population: 277,000
- GDP per capita: U.S. \$16,000
- Weather: Temp. range 70 - 88° F
- Precip.: 70 in./year, trade winds



## DUBAI

- Area: 2,707 sq. miles
- Population: 2.106 million
- GDP per capita: U.S. \$41,459
- Weather: Temp. range 60°-117°
- Precip.: 94 in./year (winter)



# Customer type by load: Barbados vs. Dubai



Customer Category	# of Customers	% Customers	% Consumption	kWh/ account
Residential	106,154	85%	33%	2,825
Commercial	17,963	14%	41%	20,760
Industrial	159	0.1%	22%	1,266,000
Others	551	0.9%	4%	2,800,000
Total	114,817	100%	100%	7,858

Customer Category	# of Customers	% Customers	% Consumption	kWh/ account
Residential	421,434	73%	31%	21,913
Commercial	150,383	26%	50%	99,765
Industrial	2,190	0.4%	9%	1,192,694
Others	6,812	1%	10%	419,701
Total	580,819	100%	100%	51,150

**Total annual consumption: 912,000 MWh**

**System peak: 156 MW; 67% load factor**

**Total annual consumption: 35 million MWh**

**System peak: 6,637 MW; 60% load factor**

# Electricity rates

## BARBADOS

Domestic (Residential) US\$	
customer charge	\$ 5.00
kWh (100)	\$ 0.08
kWh (next 400)	\$ 0.09
kWh (next 1000)	\$ 0.10
kWh (over 1500)	\$ 0.11
Fuel charge/kWh	\$ 0.21
Overall Average	\$ 0.33

Commercial US\$	
customer charge	\$ 10.00
kWh (100)	\$ 0.09
kWh (next 400)	\$ 0.11
kWh (next 1000)	\$ 0.13
kWh (over 1500)	\$ 0.15
Fuel charge/kWh	\$ 0.21
Overall Average	\$ 0.41

Industrial US\$	
customer charge	\$ 150.00
Energy (kWh)	\$ 0.06
Demand (KVA)	\$ 11.00
Fuel charge/kWh	\$ 0.21
Overall Average	\$ 0.35

## DUBAI

### Electricity Tariff

SG6

Residential / Commercial		Industrial	
Consumption/ month	Slab tariff	Consumption/ month	Slab tariff
G: 0-2000 kWh	23 fils / kWh	G: 0-10000 kWh	23 fils / kWh
Y: 2001-4000 kWh	28 fils / kWh	Y: 10001 kWh & Above	38 fils / kWh
O: 4001-6000 kWh	32 fils / kWh		
R: 6001 kWh & Above	38 fils / kWh		

Consumption/ month – Res.	Slab tariff per kWh
G: 0-2000 kWh	US\$.06
Y: 2001-4000 kWh	\$.08
O: 4001-6000 kWh	\$.09
R: 6001 kWh and above	\$.10

Consumption/ month - Industrial	Slab tariff per kWh
G: 0-10000 kWh	US\$.06
Y: 10001 kWh and above	\$.10

**Barbados electric costs are 3-4 times higher than in Dubai and more volatile (fuel)**

## Slide 6

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**SG6**

We do not need to retain the AED or fils original table. I just kept it there so you can see how I converted it to USD and what my source was (DEWA, of course :))

Sadhasivan, Gomathi, 10/18/2015

# Survey – Demographic profile

## BARBADOS

Home Ownership Status	Own/buying	93.2%
	Rent	5.3%
	Occupied without rent	1.5%
House Type	Single-family detached	94.6%
	Single family attached	2.1%
	Apartment building 2-4	2.1%
	Apartment building 5+	1.2%
Gender (respondents)	Male	33.1%
	Female	66.9%
Nationality (census)	Bajan (Afro-Caribbean)	90.0%
	Euro-Bajan	4.0%
	Other	6.0%

## DUBAI

Home ownership status	Owned outright	29%
	Bought on a mortgage	9%
	Rented	56%
	Provided by employer	6%
	Provided by a public housing scheme	1%
Gender	Male	61%
	Female	39%
Age Group	18 to 24	8%
	25 to 29	21%
	30 to 34	27%
	35 to 39	19%
	40+	25%
Income	Below \$1600	26%
	\$1600 to \$2665	12%
	\$2666 to \$5332	18%
	\$5333 and above	27%
	Prefer not to say / Don't know	16%
Nationality	Emirati	12%
	Expats	88%
Marital Status	Single	29%
	Married - with children	54%
	Married - no children	14%
	Other	3%
Employment Status	Working	83%
	Not working	17%





# Barbados

# Overview

Caribbean island just north of South America

125,000 electric customers served by Barbados Light & Power Co. (BLPC), acquired by Emera (Canadian) in 2010/2011

High dependence on imported oil for generation

- high and volatile electric prices (fuel adjustment most of bill): U.S. \$0.15-\$0.25 + \$0.25-\$0.45 fuel charges

No organized DSM initiatives to date

- Tax incentives for solar thermal water heating (35% sat.)

2012 IRP issued early 2014, recommended DSM study

DSM study commissioned in 2014, retained DNV GL

- Project conducted from February to September 2015

# Objectives and Scope of the BLPC DSM Study Project



## Evaluation of DSM opportunities

Project initiation

- Research and work plan development

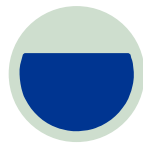
**Conduct surveys & on-sites (design/train local contractor)**

Develop framework

Conduct energy and DSM assessment/**potential study** (DSMAssyst™)

Evaluate market potential

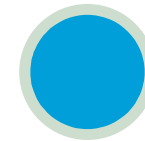
- Best measures
- Program concepts



## DSM action plan

Identify appropriate DSM programs

Monitoring and tracking plan



## Capacity building

Introduction and training for staff **and stakeholders**

- Key information needed:
  - Baseline appliance/end use data
  - BUT, no current market research!
  - Availability and awareness of energy efficiency products – no prior surveys
- Key results needed:
  - How much saving potential is there – and in what market segments and measures
  - What costs are associated with these savings?

# Barbados survey design

## Target populations (by rate class: res./domestic, small comm. medium/large)

- Local Contractor (DNV GL-trained) Completed 200 household, 283 business (C&I) surveys
- Res mostly phone, C&I mostly on-site, Conducted Nov. 2014 – Jan. 2015

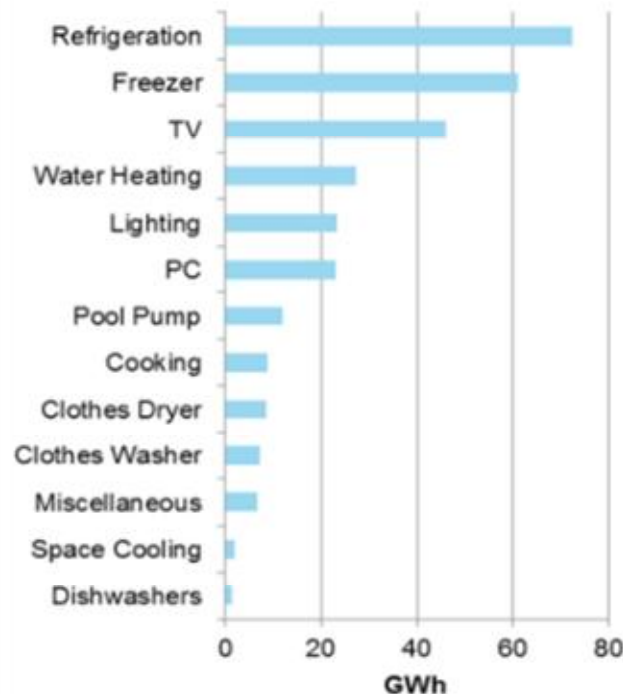
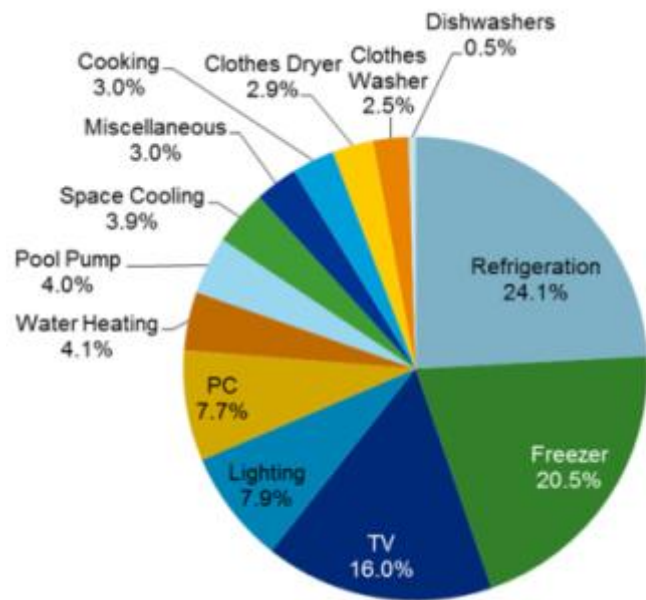
## Types of questions

- Customer types (business type)
- How is electric bill paid? (owner/landlord)
- Building vintage, size, construction, roof color, windows

## Residential end uses: cooling, water heater, refrigeration, lighting, other

- Age, size, type (proxies for efficiency)
- Cooling operations (thermostat, use patterns, fans)
- Water heat (solar thermal, tanks, instant, on-demand, boosters)
- Lighting (incandescent, CFL, fluorescent, LED, controls); high/low use
- Other (washers, dryers, pools, TV, set-tops, PCs, other)
- Specific high-efficiency equipment
- Interest in efficiency; What info. would help?
- Demographics

# Results: Baseline residential energy use



Which appliances/end uses are considered high efficiency	
Lighting	18.5%
Refrigerator	6.7%
Computer	4.4%
LCD TV	3.9%
LED TV	2.7%
Clothes washer	2.6%
Printer/scanner units	2.3%
Computer modem	1.9%
Home audio equipment	1.8%
Other	0.9%
VCRs/DVD players	0.8%
Freezer	0.5%
Split A/C System	0.5%
Computer monitor	0.4%
Ceiling fans	0.3%
Room air conditioner	0.1%

- Average Barbadian household consumes just under 3,000 kWh/yr.
- 1/3 of single family households have air-conditioning equipment, but most only use it to cool down briefly
- 10% of households have 2 refrigerators, 100% have 1; 20% have freezers
- Only lighting has a significant saturation of high-efficiency
- 35% of residences have solar thermal water heating

## Results: Survey questions on interest/awareness

How Interested in Learning how to save energy in home (0-10 scale)		
9 or 10	Very interested	35.9%
7 or 8		16.0%
5 or 6		13.5%
3 or 4		8.3%
1 or 2	Not interested	26.3%

- Moderate to high interest in learning about energy
- 1/4 of residents not interested in learning

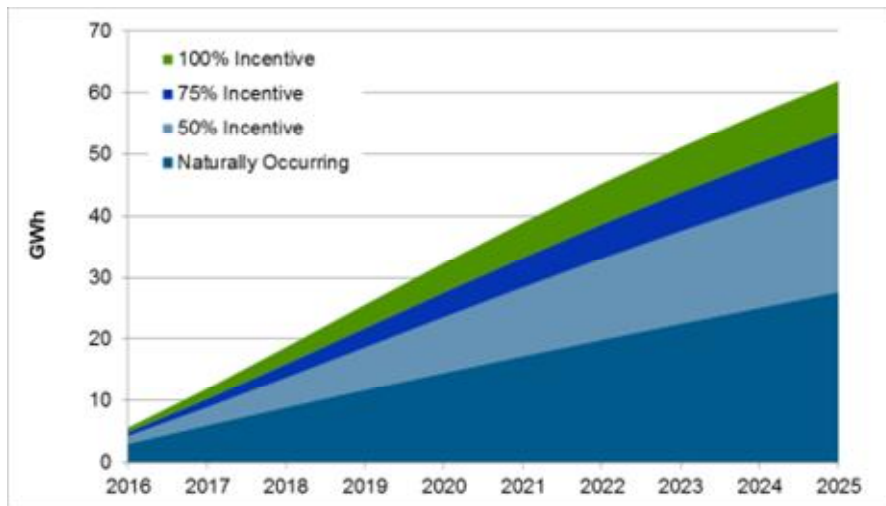
- Residents are mostly interested in tips for energy savings
- Some interest in incentives, audits and renewables
- 1/3 of residents not interested in information

Type of Information interested in	
Tips on how to save money and conserve energy	61.6%
Tips on how to make my home more energy efficient	56.6%
Information on rebate and incentive programs	24.7%
Having an energy audit done on my home	11.8%
Renewable Energy for Wind or Solar PV	15.8%
Not interested in any information	32.8%

# Strong potential for savings in Barbados

## Achievable Energy Savings by Sector

### Residential Sector Savings



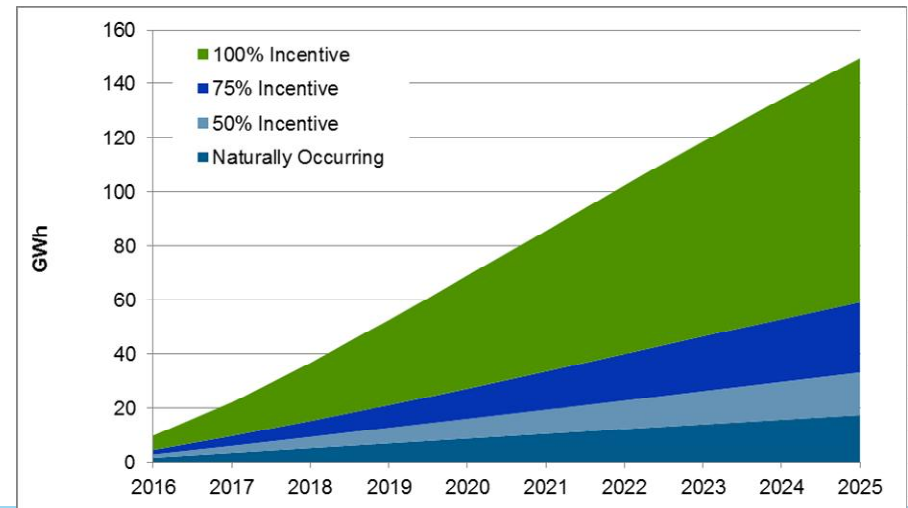
#### Primary measures:

- Comparative bills/Behavioral Program
- Refrigerators/refrigerator recycling
- Freezers/freezer Recycling
- Pool Pump
- TV
- LED

### Business Sector Savings

#### Primary measures:

- Lighting: Controls, Outdoor LEDs, T8 Fluorescent
- Package A/C (DX)
- ENERGY STAR Cooking
- Energy Star office equipment
- Ductless Split-System air conditioners
- Variable Speed Drives for motors



# Barbados:

## Key design features for how to change behavior

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### Barriers and considerations

Limited awareness of concepts

Limited knowledge of products

Product availability and lack of experience among suppliers and contractors

High incremental costs between standard and high efficiency options

Need for aggressive engagement with high potential sectors

### Design features

Public awareness campaign

Educational components

Trade ally program

Incentives of 50% of incremental cost to help reduce first cost while limiting DSM budget outlay

Business association engagement for hotels and other key segments



# Conclusions - Barbados

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Survey indicates strong consumer interest in information and DIY energy efficiency

Low adoption of high-efficiency appliances/end uses – availability and awareness - except lighting (sporadic)

Low consumption and use of cooling reflects high prices and volatility

Small, but significant percentage of customers (1/4 – 1/3) not interested in energy savings

Refrigeration/2<sup>nd</sup> units and freezers have the most usage and most potential (low efficiency and 50/60 cycle issue)

Strong indications of intentions to take action to achieve savings if tips and incentives provided



# Dubai



# Overview

Part of the United Arab Emirates, fast growing economy based on retail, tourism and shipping

Government utility – Dubai Electricity and Water Authority (DEWA)

High dependence on oil for generation

Recent nascent DSM initiatives planned in 2013

- DSM potential study and action plan completed, but limited implementation to date

Regulator responsible for enabling regulations for achieving government targets – 30% savings by 2030 for UAE

Retained DNV GL to design building regulations

- Project conducted from Nov. 2014 – July 2015

# Scope of study and sample

Regulations for mandating audits, submetering, benchmarking and data disclosure

Online survey of members of an existing consumer panel

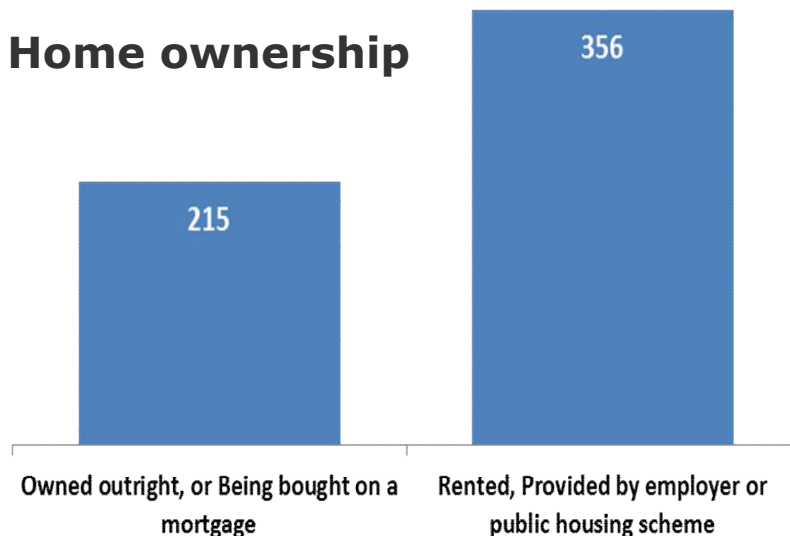
Survey fielded April 23, 2015 – May 12, 2015

Approximate average completion time ~ 14 minutes

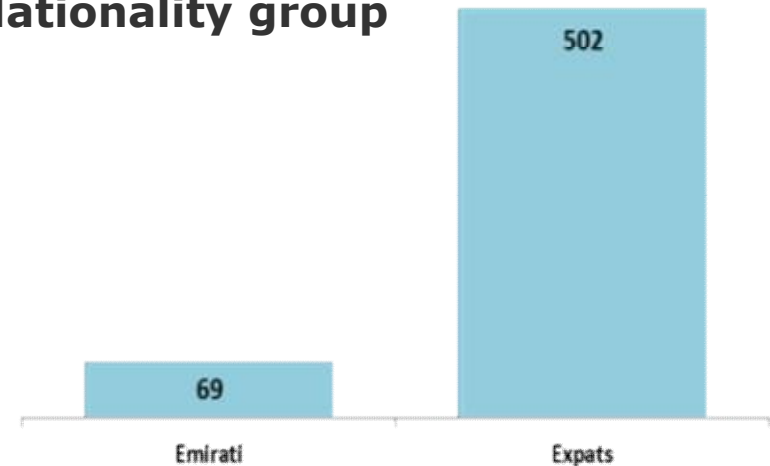
Findings based on 571 completed surveys

Sample – representative and diverse

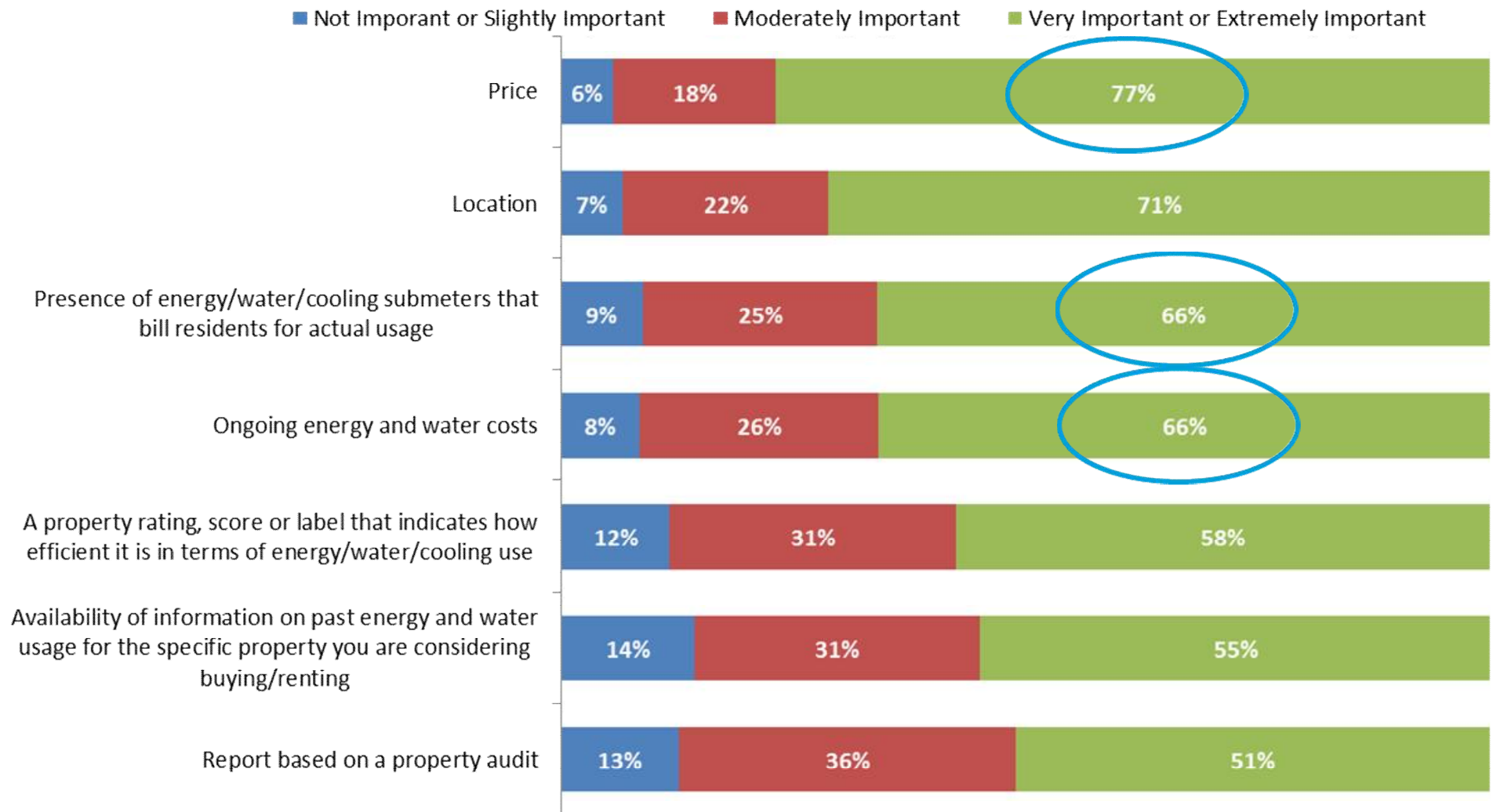
**Home ownership**



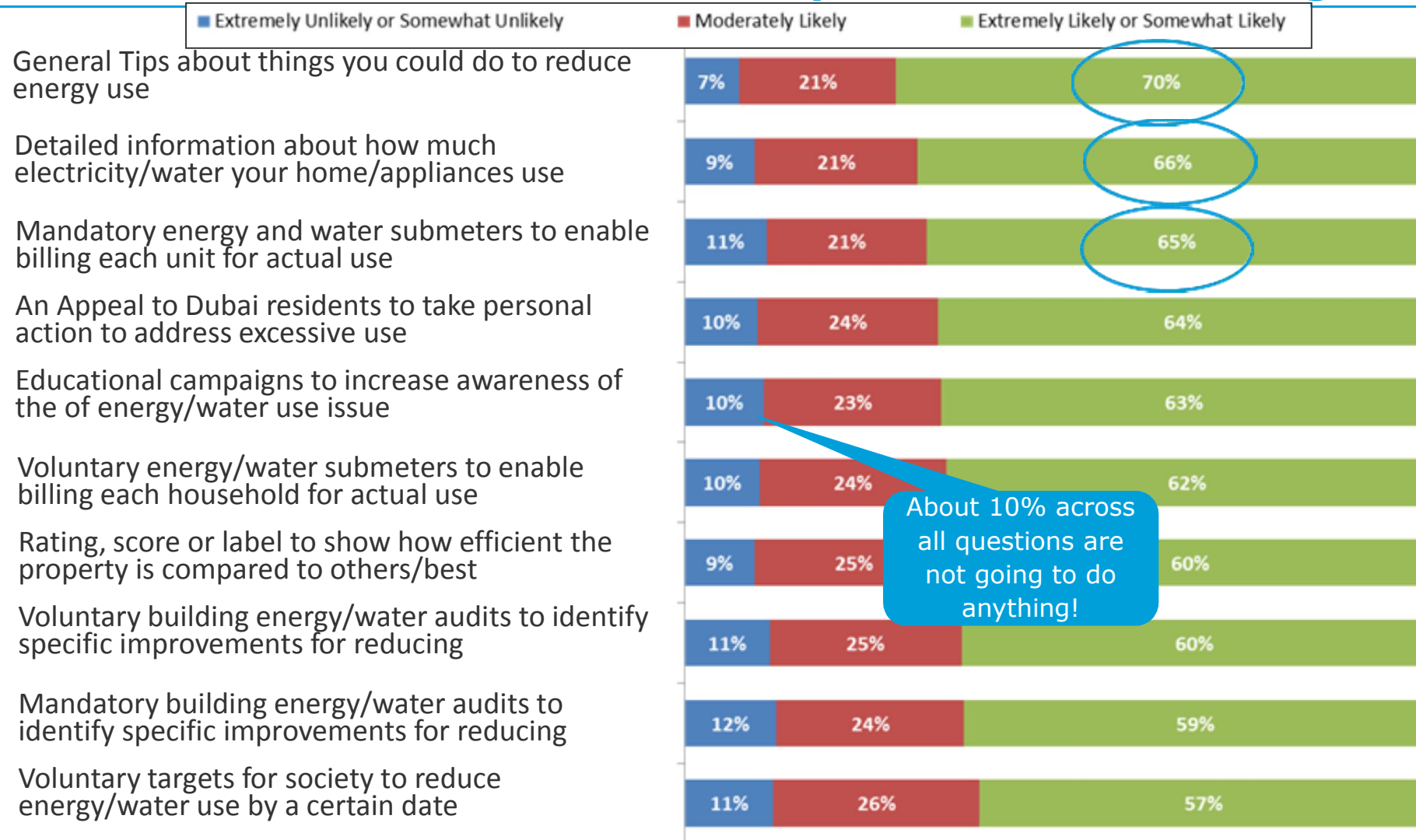
**Nationality group**



# Importance in property search/selection



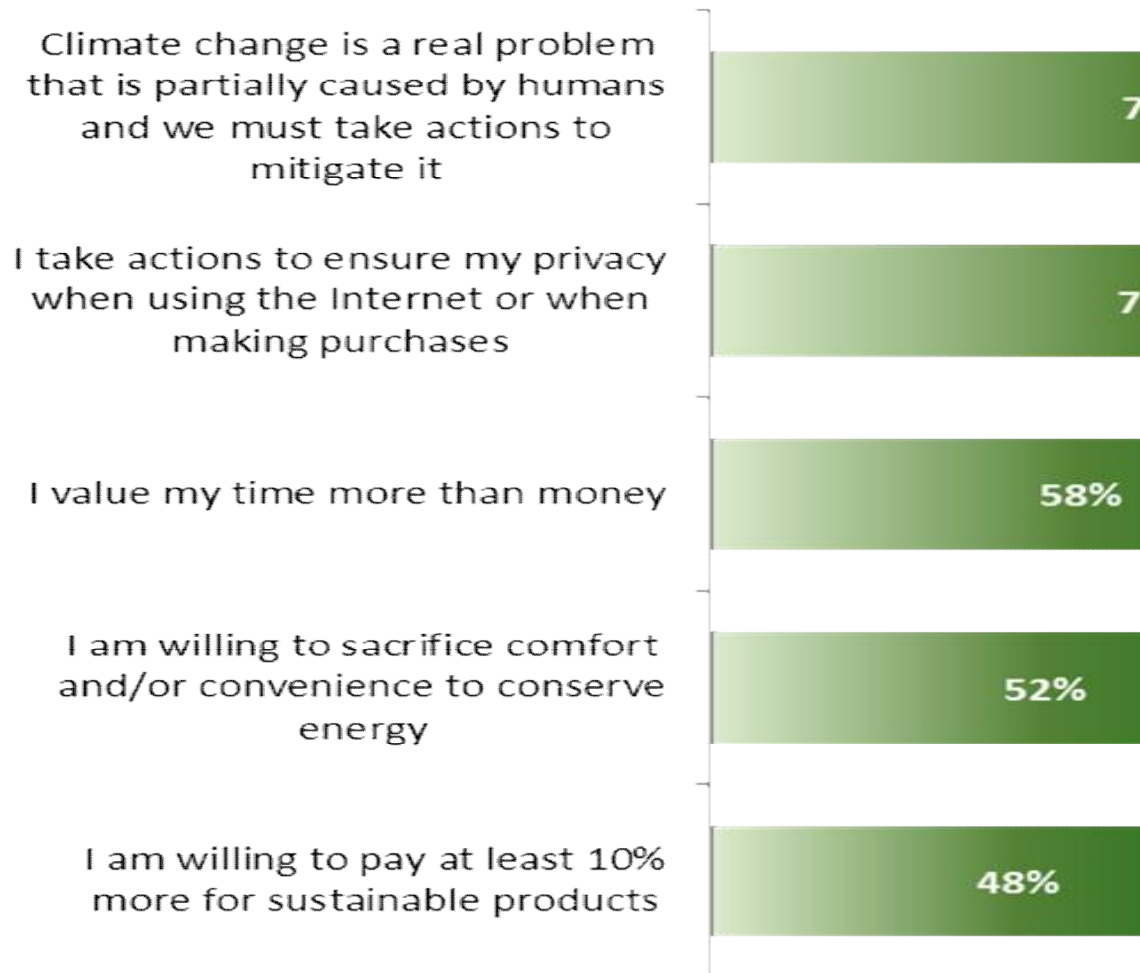
# Likelihood to install/adopt energy and water efficiency measures/retrofits in home in response to the following



Note: 3-7% of respondents stated 'Don't know/ Not applicable' for each question and have been omitted from charts.

# Market profile – values and attitudes

## Strongly or Somewhat Agree



- 46% stated that energy and water usage costs are quite high and unaffordable
- 70% are very or extremely interested in lowering the amount they pay for energy and water usage
- 27% does not have central air conditioning and receives cooling from personal air conditioners (window or split)
- 32% of those with district / central cooling pay a flat amount that does not vary with consumption

# Conclusions - Dubai

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Survey indicates  
consumer support  
for regulatory  
elements

Price signals via  
sub-metering rises  
to the top as a  
preferred  
mechanism

Consumers value  
information – both  
general tips for EE  
and based on past  
usage

Almost half the  
market perceives  
total electricity  
and water costs to  
be high

Strong indications  
of intentions to  
take action to  
achieve savings



# Result – Regulatory Framework

A regulatory framework for building retrofits to enhance efficiency, delivers timely information and protect customers.

## 1. Energy and Water Audits & Retrofits

### Audits

Energy and water efficiency audits establish baseline consumption and efficiency improvements

### Retrofits

Voluntary action based upon audit recommendations: retrofits and behaviour changes.

## 2. Sub-Metering

For buildings and accounts with multiple premises, sub-meters are to be installed

## 3. Benchmarking & Disclosure

Consumers and market actors to have access to building data for making informed decisions.

## 4. Information Disclosure to 3rd Parties

Protections regarding data on buildings and premises to third parties.



# Comparative Conclusions

# Comparative Conclusions: Doing Market Research

## ■ Barbados

- Lack of technology and customer preference resulted in many face-to-face interviews (businesses)
- Limited local capacity for energy-related survey research, extensive training required
- High level of technical competence (e.g. load studies) but lack of specific DSM experience
- Excellent utility cooperation re: data provision, general responsiveness to data request

## ■ Dubai

- Privacy is key! Both respondents and the client overly cautious about intrusiveness of survey research
- Many agencies wanted the information...
- But NOBODY wanted to provide basic data to enable us to do surveys
- Must take into account cultural norms (e.g. personal and business freedom), biases
- Very complex societal structure and rules impacts sample design SG13

***How are they alike?*** Lack of familiarity with energy behavior research, limited local capacity, no good baseline info for DSM planning purposes

## Slide 26

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### SG13

ownership status and government bodies that preside over different zones - freehold and non freehold and free zone vs non free zone.

Sadhasivan, Gomathi, 10/18/2015

# Comparative Conclusions re: Energy Behavior

- Contextual issues are important to capture
- The capacity to alter behavior is key: e.g.,
  - technical potential
  - product availability/compatibility
  - product prices
- What are people's general attitudes about taking action? Do they typically
  - Want to be given information only
  - Want to be presented with a good deal (e.g. monetary)?
  - Want to do good for society?

## Characteristics impacting potential for behavior change and ways to encourage it

Barbados	Dubai
Respectful, resourceful	Entitled, cutting edge
Egalitarian, self directed society	Paternalistic society, dependent on others
Strong tech potential	Strong tech potential
High energy rates and bills (big price signal)	Subsidized rates, high bills (no price signal)
Moderate to low usage	Very high usage
Limited product availability, high cost to obtain, high prices	Some product availability, cost not an issue, other features
High need for information on types and value of actions	Interest in information on taking personal control



# Questions?

**DNV GL Energy assists our clients in delivering a safe, reliable, efficient, and sustainable energy supply around the globe.**

**Joseph S. Lopes**

**Barbados Light & Power Company DSM Study Project Manager**

**Dubai Regulatory Supervisory Bureau Study – Subject Matter Expert**

Joseph.lopes@dnvgl.com

516-277-1087

**[www.dnvgl.com](http://www.dnvgl.com)**

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