* Conservation Motivation,

Water Arabia Conference,

ارامكو السعودية
Saudi Aramco
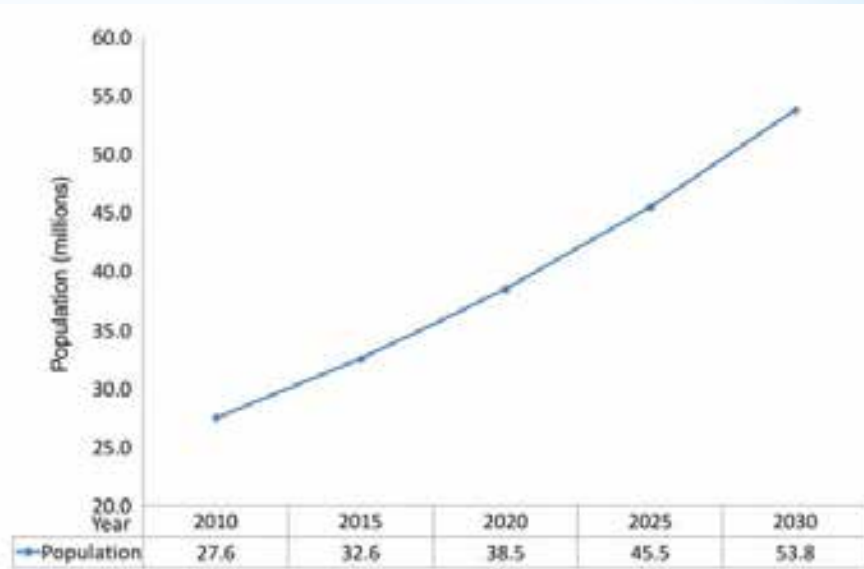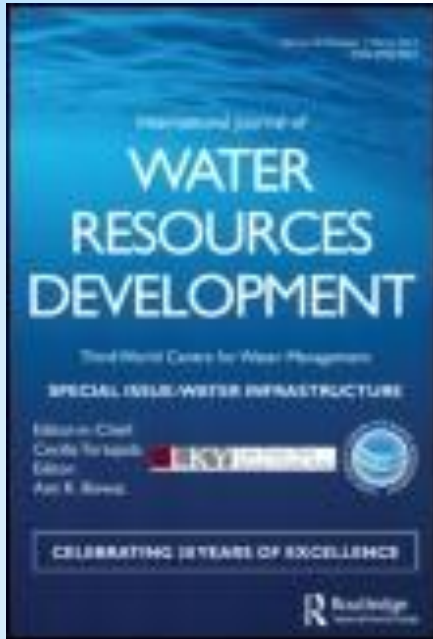
David Good, PE, LEED AP
Feb. 19, 2015

Figure 1. Population forecast for the Kingdom of Saudi Arabia.

*Omar K.M. Ouda (2014)
"Water demand versus supply in Saudi Arabia: current and future challenges"

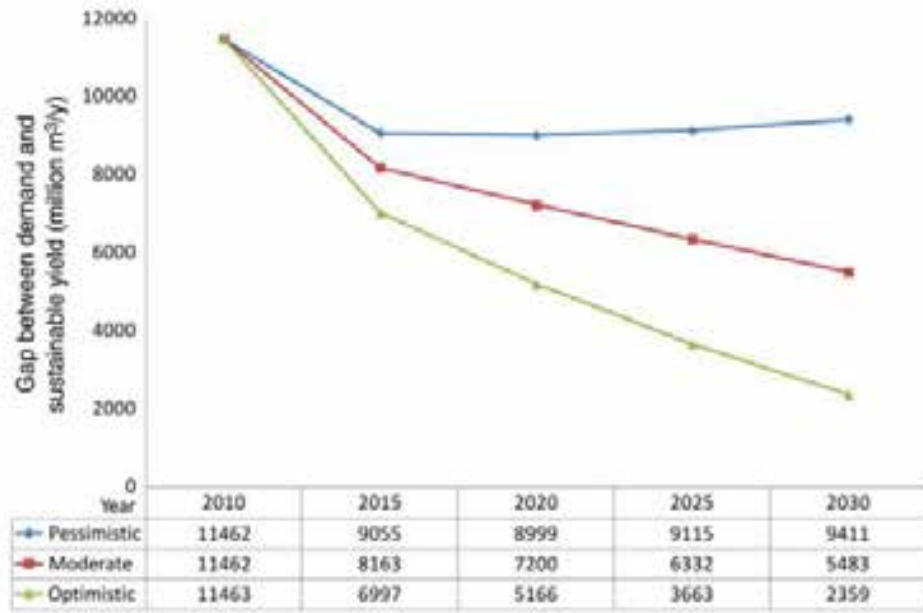Conservation Motivation: D, Good, PE, LEED AP   2

Figure 7.   Projected demand-versus-supply gaps.

*Increase in Consumers

* "The agricultural sector is currently consuming 85% of the total water demand in the KSA. The government plans to reduce agricultural water demand by 3.7% annually. The research results prove the validity of this approach. A small annual decrease in agricultural water demand will have major positive impacts on total demand and will help in bridging the gap between demand and supply."

* The Harsh Reality

* "Further research is recommended to identify and evaluate the most effective technical, economic and social measures to reduce agricultural water demand in Saudi Arabia."

* The Harsh Reality

* Economics 101

* **Resources are scarce.**

* Physics 101

* **Mass is conserved.**

* **The Harsh Reality**

*Economics 102

*Reduced food production and increased population

=

*Food Security Concerns

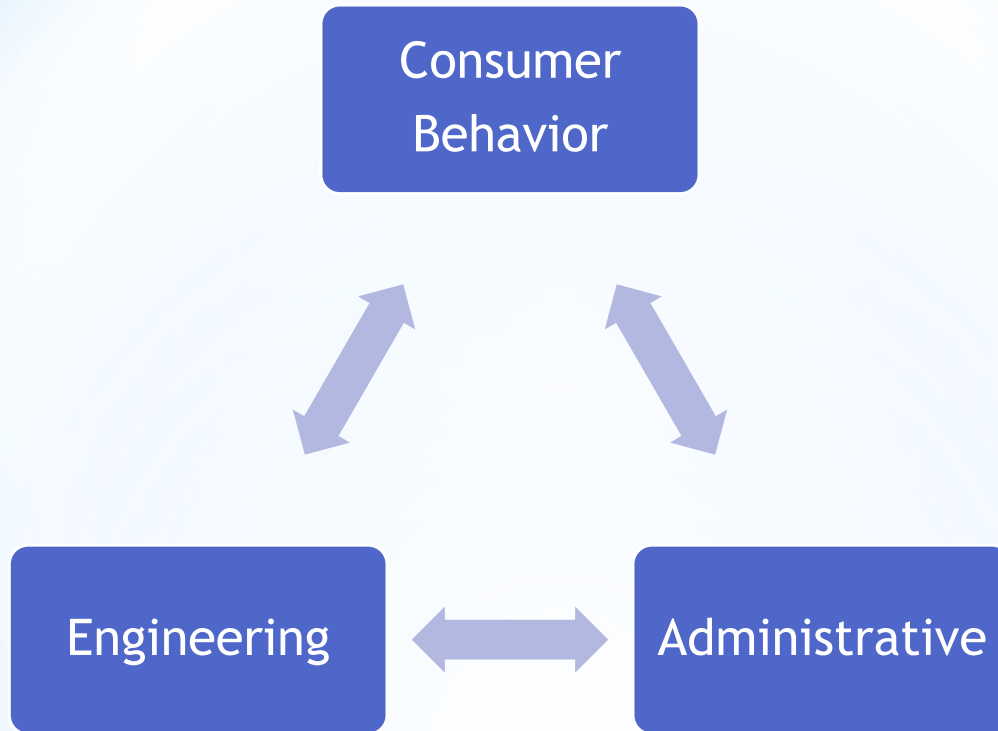*The Harsh Reality

Three Principle Methods to Control Behavior

* 1. Engineering Behavior Controls
  * Technology
* 2. Administrative Behavior Controls
  * Laws and Polices
* 3. Personal Behavior Controls
  * Consumer

* How to slow demand growth?

Three approaches

* Do nothing

* Do something

* Do all things

* **What to do?**

Consumer Behavior

Engineering

Administrative

*Best Conservation Solution

* Leverage Technology Behavior Controls
  * Drive Development
  * Drive Selection, Availability and Distribution
  * Deploy Technology
  * New applications for existing technology
* Smart Administrative Behavior Controls
* Motivate the Consumer Behavior Controls
  * Personal Behavior
  * Cultural Behavior
  * Cross Cultural Behavior

* How to Maximize Conservation?

* **Leverage Technology Behavior Controls**
  * Drive Development
  * Drive Selection, Availability and Distribution
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  * New applications for existing technology
* Smart Administrative Behavior Controls
* Motivate the Consumer Behavior Controls
  * Personal Behavior
  * Cultural Behavior
  * Cross Cultural Behavior

* How to Maximize Conservation?

* Drive Development
  * Grants and patent support.
  * Incentive programs for new technology development.
  * New applications for existing technology.
  * Reduce the hot water lag.
  * Drive selection and availability of fixtures (vendor assistance programs).
  * Distribution, reliable supply chain (vendor assistance programs).

* Leverage Technology

* Drive Development
  * Grants for Agricultural Innovation.
    * Low water-intensive and high yield crops.

http://en.wikipedia.org/wiki/Living_with_the_Land#mediaviewer/File:Tomatotree.JPG

* Leverage Technology

* <u>Drive Development</u>
  * Grants for Agricultural Innovation.
    * Low water-intensive and high yield crops.
    * Vertical farming.

* # Leverage Technology

* <u>Drive Development</u>
  * Grants for Agricultural Innovation.
    * Low water-intensive and high yield crops.
    * Vertical farming.
    * Intercropping.
    * Low water consumption techniques.

http://en.wikipedia.org/wiki/Living_with_the_Land#mediaviewer/File:Disney_the_land_intercropping.jpg

* Leverage Technology

* Drive Selection, Availability and Distribution

* The Khobar Connection – **Why?**
  * Places selection behind closed doors.
  * Selection is limited to vendor suppliers.
  * Distribution of high demand fixtures is unreliable.

* Take a lesson from Amazon
  * Internet shopping.
  * Direct delivery.
  * Schedule your installation.

* Leverage Technology

* Deploy Technology
  * Incentive programs for replacement of existing high flow fixtures (exchange programs).
    * Low flow shower heads.
    * Low flow lavatory faucets.
    * Low flow toilets.
    * Waterless urinals.
    * Irrigation system timers and moisture sensing controls.
    * Move institutional devices into the home (e.g., IR lavatory faucets).
  * Supply Chain reliability
  * Installation reliability

* Leverage Technology

* New applications for existing technology
  * SW/RW usage delineation (mixing valves).
  * Leak detectors.
  * Occupancy sensor fixtures in homes.
  * Grey water reuse or recycled use of ablution water:
    * Recycle
    * Reuse
  * Reduce the hot water lag.
  * Move institutional devices into the home (e.g., IR lavatory faucets).

* Leverage Technology

* Leverage Technology Behavior Controls
  * Drive Development.
  * Drive Selection, Availability and Distribution.
  * Deploy Technology.
  * New applications for existing technology.
* **Smart Administrative Behavior Controls.**
* Motivate the Consumer Behavior Controls.
  * Personal Behavior.
  * Cultural Behavior.
  * Cross Cultural Behavior.

* How to Maximize Conservation?

* Public Policy
  * New construction
  * Renovation
  * New Applications
    * Grey water reuse or recycled use of ablution water.
    * Irrigation after sundown.
* Cost incentives
  * Super User Rates
 * Super Saver Rates
  * Off hour incentives
* Fines

* Smart Administrative Controls

* Leverage Technology Behavior Controls.
  * Drive Development.
  * Drive Selection, Availability and Distribution.
  * Deploy Technology.
  * New applications for existing technology.
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* **Motivate the Consumer Behavior Controls.**
  * Personal Behavior.
  * Cultural Behavior.
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* How to Maximize Conservation?

* Personal Behavior.

* Cultural Behavior.

* Cross Cultural Behavior.

* Motivations
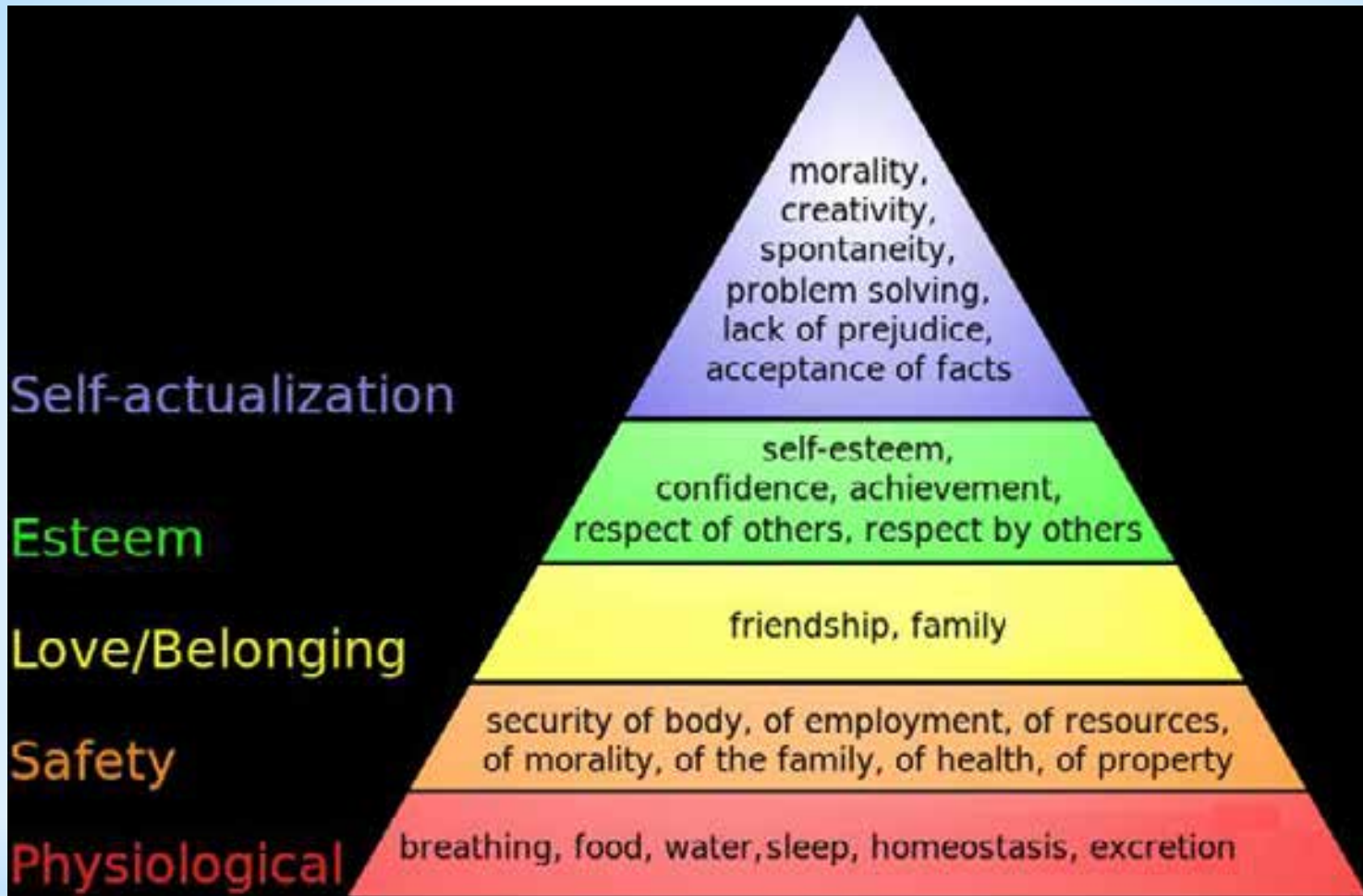
Maslow's Hierarchy of needs: From Wikimedia Commons, the free media repository

*Motivations, Personal

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Saudi Aramco: Non-Business Use

* Responsibility
* Recognition
* Status
* Remuneration
* Security

* Motivations, Personal

*Personal Stake
*Personal Effect

*Motivations, Cultural

* Public figures installing/using technology
  * Media release/campaign of Prince ____ retrofitting home with low flow fixtures.
  * Media release/campaign of Prince ____ using the Internet Fixture Store.
  * Media release/campaign of Prince ____ using portion control techniques.

* **Modeling**

* Reaching all cultures in Saudi Arabia
  * Males
  * Females
  * Technical Expats
  * Non-Technical Expats
  * **Youth**

* Motivations, Cross Cultural

Motivations are similar, Means will vary

* Cross cultural awareness campaign
* Consult with Advertisement Agencies /Marketing Firms
    * Radio, TV, Billboards
    * Guerilla Marketing
        * Schools
        * Games
        * Internet Ads
        * Take a lesson from Geico™ Insurance

* Motivations, Cross Cultural

* Long-Term Problem

* Requires Long-Term Thinking
  * All Means
  * All Methods
  * All Cultures

* Conservation
Motivation Solution

*Thank You

*Conservation
Motivation Solution