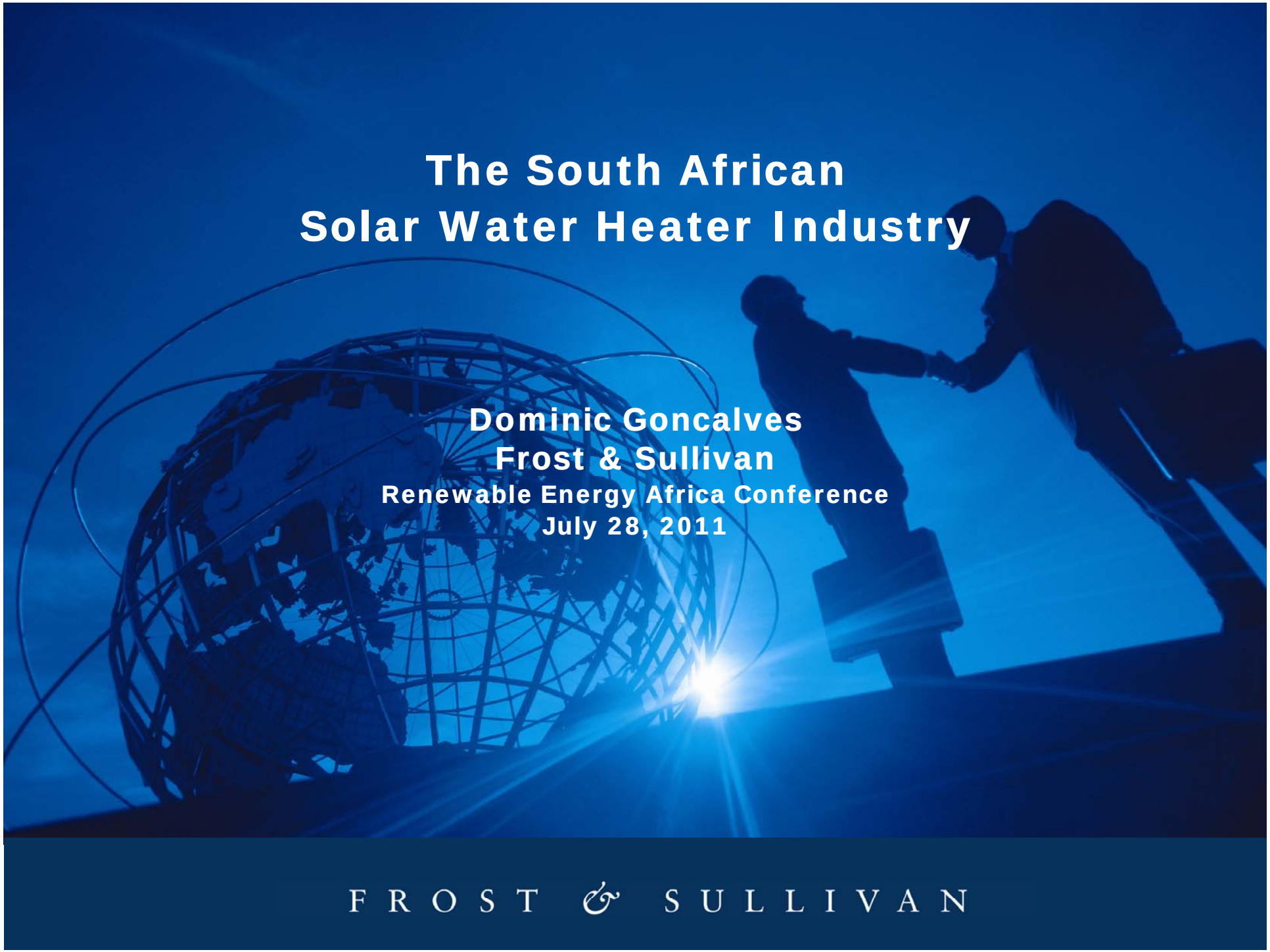


The South African Solar Water Heater Industry

Dominic Goncalves
Frost & Sullivan

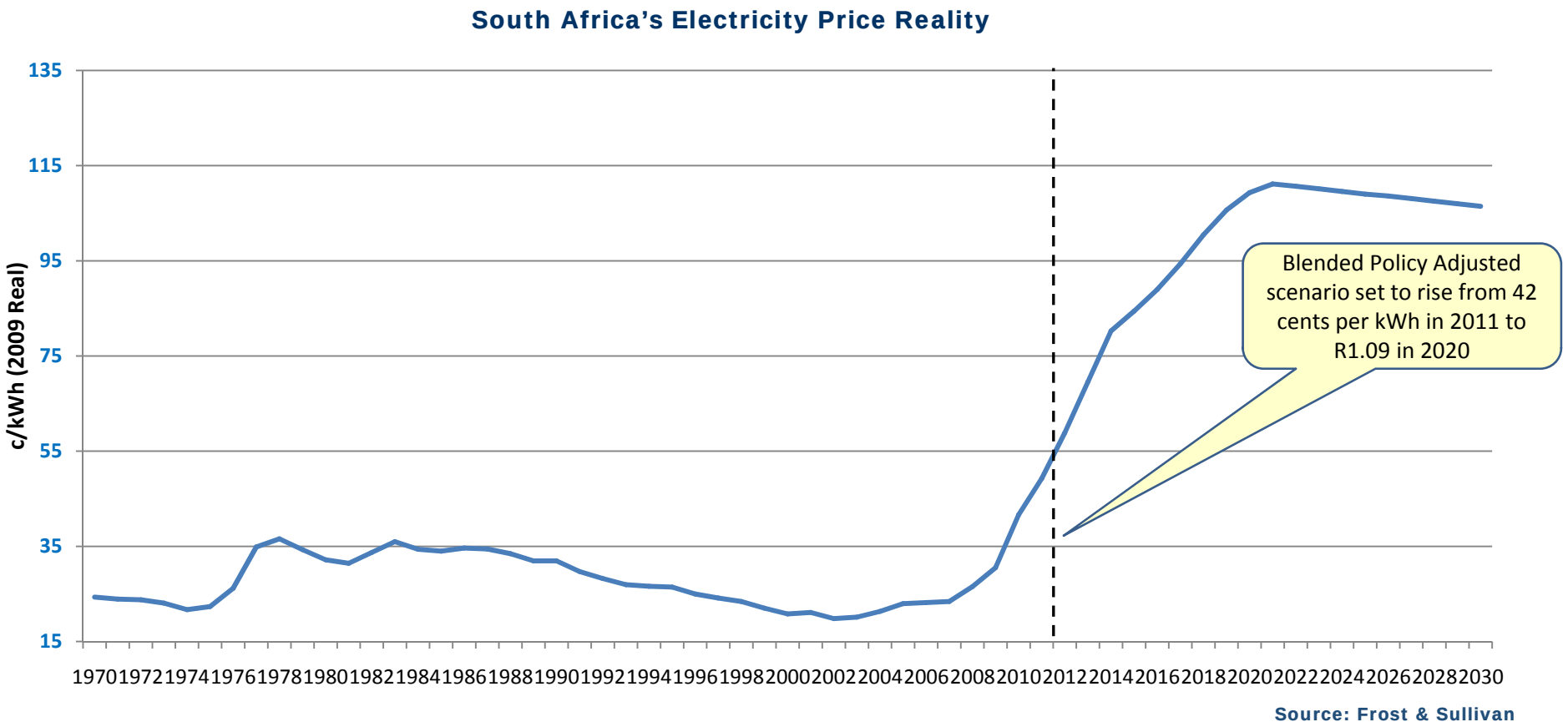
Renewable Energy Africa Conference
July 28, 2011

FROST & SULLIVAN

Focal Points

- South Africa's Electricity Price Reality
- SWH in Context
- Carbon Benefits
- Global Policy Mechanisms for SWH
- BAU vs. Inclusion of New Building Code Regulations
- Efficient Water Heating in South Africa: Product Lifecycle
- Skills Shortage
- The Barcelona Solar Experience
- Flanking Measures Needed to Facilitate Growth

South Africa's Electricity Price Reality



Source: Frost & Sullivan

South Africa has to navigate a tight course between security of supply and an increasing tariff, with impending implications from carbon taxation

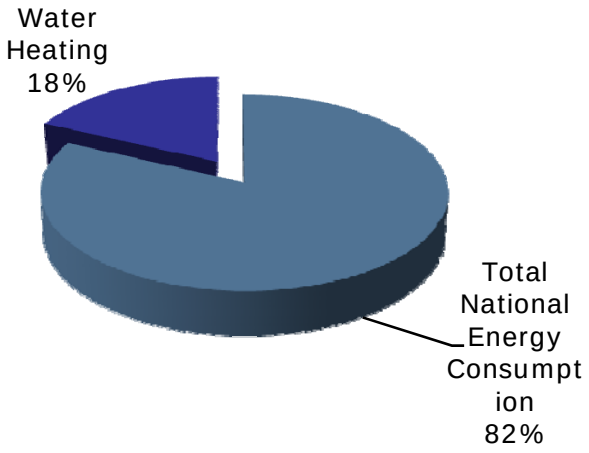
SWH in Context

South African EWH Market Initiation

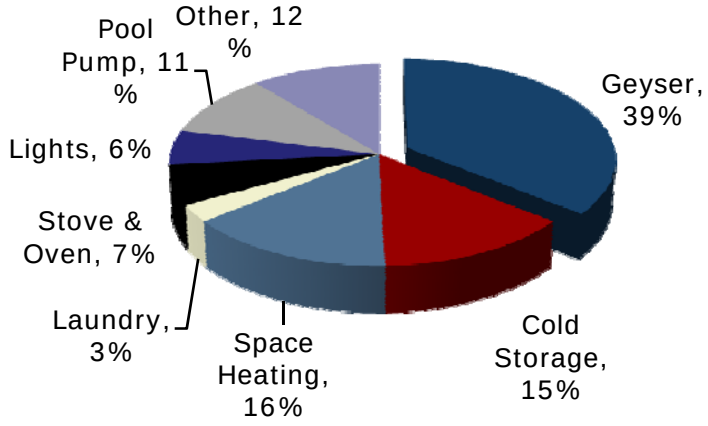
Motivation for SWH Implementation

- Load shedding
- Electricity crisis
- DSM
- In order to provide funding for required generation capacity growth, NERSA approved Eskom's application for annual electricity tariff hikes of 25% for the 2012-2014 period
- However, until sufficient generation capacity can be commissioned, security of supply is still expected to be threatened for the 2010 to 2016 period
- Supply gap compounded by the delay in the completion of Medupi and Kusile
- Efficient water heating is identified as a prime mechanism for demand side management
- Other drivers for the project include job creation, skills development, reduction of carbon emissions

National Electricity Consumption



Domestic Electricity Consumption



Source: Frost & Sullivan

Carbon Benefits

- 18% of total national electricity supply is allocated toward the heating of water
- The heating of water consumes as much as 40% of domestic electricity usage
- Efficient water heating thus provides both environmental and economic benefits
  - For every 1kWh of energy produced by a coal power station, 0.966kg of carbon dioxide is produced
  - The energy saving of a single SWH will result in an annual average saving of over 2,400 kWh
  - This amounts to a CO2 saving of 2,320 kg of carbon dioxide per year, per SWH
- If one million solar water heaters were installed in South Africa, this could alleviate 578GWh of electricity from the grid annually, the equivalent output of a 2,000MW power station
  - The avoided resources depletion externality results in the conservation of 3,1 million litres of water and 1.2 million tons of coal
  - The carbon emissions offset possible for the installation of one million solar water heaters would save 2,320 billion tons of carbon

Source: Frost & Sullivan, Eskom

One million SWH installed in South Africa would alleviate 2,320 billion tons of carbon

Global Policy Mechanisms for SWH

Policy Mechanisms for SWH

- Globally, different policy methods have been used to foster the deployment of SWH
- Primary policy mechanisms include:
  - Collector-area-based subsidies
  - Performance-based subsidies
  - Tax credits
  - Tax deduction
  - Mandatory legislation
- International best practice has shown that often a combination of these policies provide the best framework with which to facilitate the efficient deployment of SWH
- 21 countries currently have some policy measure in place to upscale the use of SWH

Rationale for SWH

- Solar water heaters globally have gained interest and popularity as a means to:
  - Reduce reliance on national energy supply
  - Take strain off peak-time power loads
  - Mitigate carbon emissions
- National support needed due to high initial cost
- International experience has shown that enabling policies, information, access to financing, supply side strengthening and sustainable institutional support are needed in this regard

Global Solar Water Heater Market

The Global Solar Water Heater Market

- More than 70 million households globally now have solar water heater systems installed (2010)
- China is the world's largest user of SWH
  - Total installed capacity of SWH is estimated at the equivalent of 154GW, more than 65 per cent of global capacity
- Countries with high per capita uptake, such as Cyprus, Israel, Spain and Austria, all have policy mechanisms in place to support this uptake
  - Cyprus' legislation requiring SWH installation in all new buildings, has resulted in 92% of residential buildings being equipped with SWH
- Spain, the world's fourth largest SWH manufacturer, has seen significant growth since 2000, with a mandatory ordinance by the City of Barcelona to install SWH in all new buildings
  - Following the success of Barcelona's municipal framework, over 60 Spanish cities have followed suit

Research indicates new building codes have been the most effective policy mechanism globally to catalyze the uptake of the solar water heater market

Source: Frost & Sullivan, REN21

The South African SWH Experience

The South African Solar Water Heater Market

- Dormant until 2007, catalyzed by the Eskom rebate program, hype, and load shedding
- Between 2007 and 2010, market volatility, quality issues
- The market began to stabilize somewhat during the second half of 2010
  - Fly-by-nights became less prevalent
  - Established companies with good word-of-mouth reputation formed efficient distribution networks, franchises and partnerships
  - Growth still relatively stunted, despite volatility
- Rebates eased

Teething Problems in the South African SWH Market

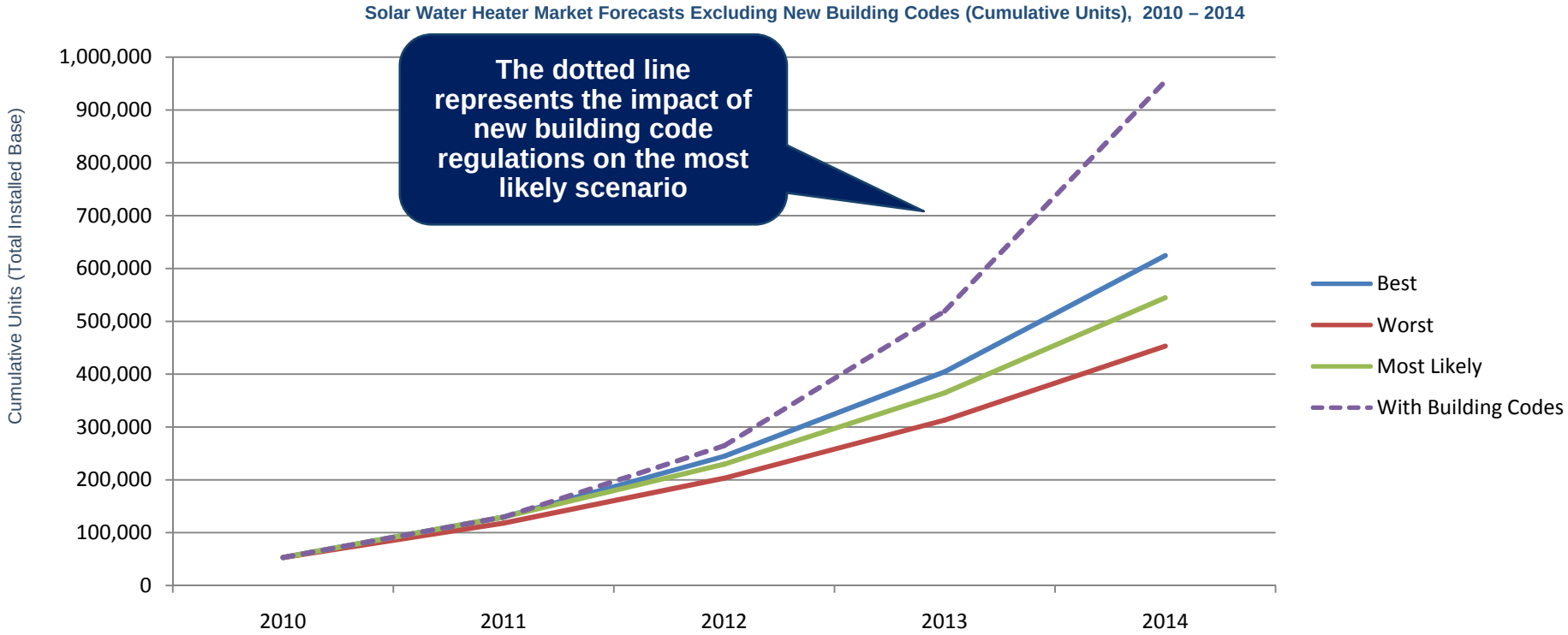
- During the first 3 years of its implementation, numerous teething problems plagued the system, causing stunted uptake

- This can be attributed to the following challenges:
  - **Consumer confusion**
  - **Low price of the rebate**
  - **Accreditation issues**
  - **Installation issues**
  - **The negative effects of installation and operational problems**
  - **And the subsequent loss of interest by the potential end-user**

Source: Frost & Sullivan, REN21

BAU vs. Inclusion of New Building Code Regulations

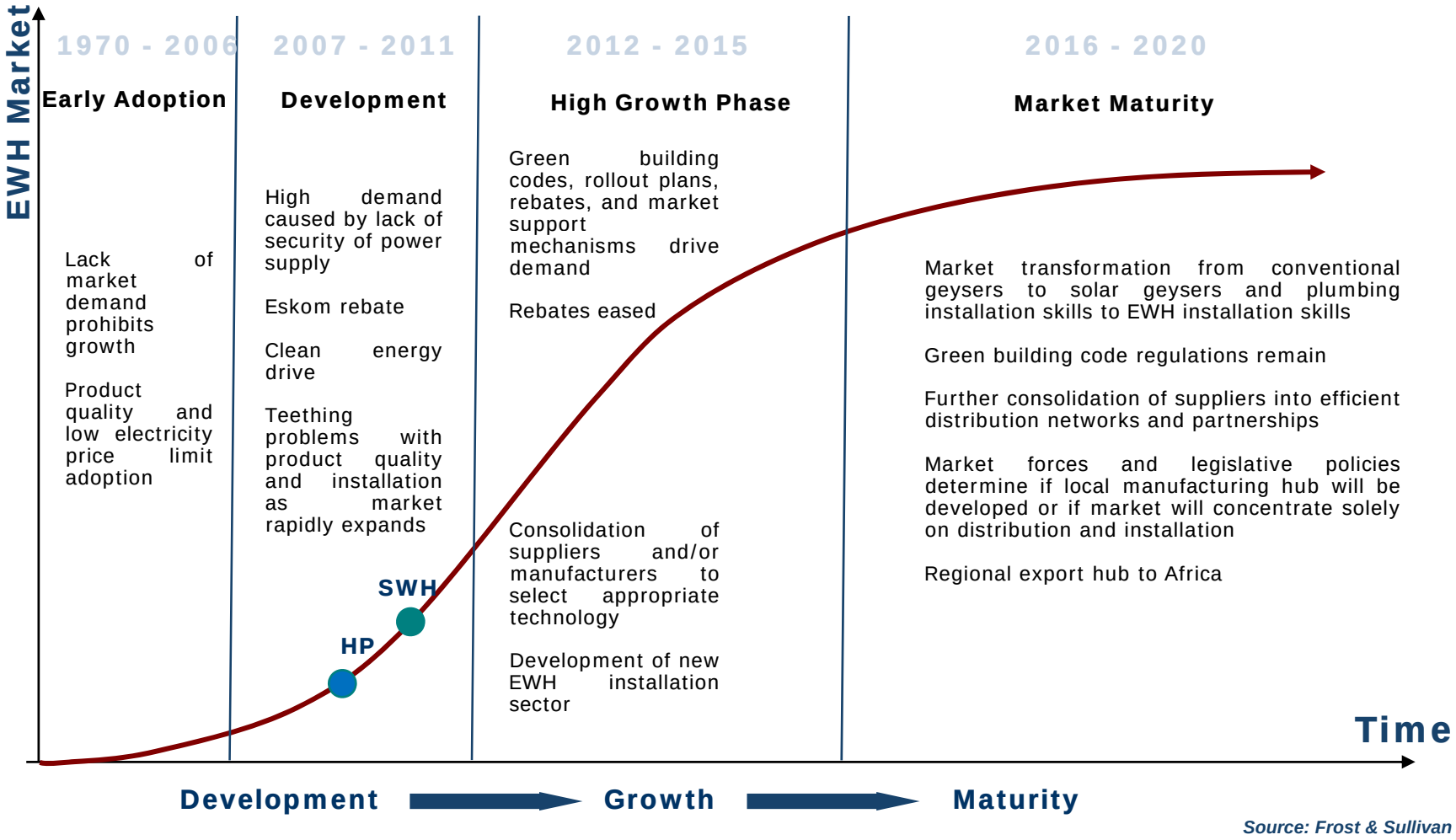
South Africa



Source: Frost & Sullivan, Blue IQ

Business-as-usual falls significantly short of the 1 million SWH target, and illustrates that, without new building code regulations, achieving this target will not be feasible

Efficient Water Heating in South Africa: Product Lifecycle



Source: Frost & Sullivan

SWH Technology

Solar Water Heating

Solar Water Heater Scoped Products

Solar Water Heating Collector Type

Evacuated Tube

- Evacuated tube SWHs consist of multiple sealed glass tubes resulting in a concentric vacuum that greatly reduces heat loss. Each tube contains an absorber plate connected to a heat pipe, which transfers heat to a liquid medium via a heat exchanger

Flat Plate

- Flat plate SWHs are a network of pipes enclosed by a glass top. A pipe is connected to the water tank and water passes through this pipe and back into the tank

Water heated by solar energy generally requires solar thermal collectors, a water storage tank, interconnecting pipes and a fluid system to move the heat from the collector to the tank
This thermodynamic approach differs from photovoltaic (PV) technology in that sunlight directly heats the water, as opposed to PV cells that generate electricity from sunlight

SWH Technology

Solar Water Heating

Solar Water Heater Scoped Products

Solar Water Heating Collecting Systems

Direct

- Direct systems, or closed loop systems, circulate water directly between the storage container and the collector
- Direct systems can generally only be used in frost-free areas, where the temperature never falls below 4 degree Celsius. In South Africa, this is limited primarily to Northern Kwa-Zulu Natal

Indirect

- Indirect systems, or open loop systems, use a non-toxic antifreeze heat transfer fluid (HTF) in the collector
- When this fluid is heated, convection causes it to flow to the tank where a passive heat exchanger transfers the heat of the HTF to the water in the tank

Solar water heater systems can be direct or indirect, depending on circulation

SWH Technology

Solar Water Heating

Solar Water Heater Scoped Products

Solar Water Heating System Configuration

Close-Coupled

- In a closed-coupled system, the storage container and collector are closely joined to each other, and are generally mounted as a single unit on a rooftop

Split

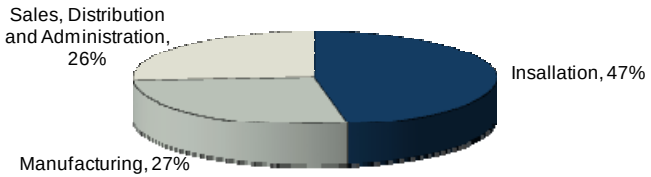
- Split systems allow for the separation of the storage container and the collector, thus allowing a flush, more aesthetic installation of just the collector on a rooftop or other mounting, while the storage container can be installed within the roof or elsewhere where it is not externally visible

Solar water heater systems can be configured as one unit or separated during installation

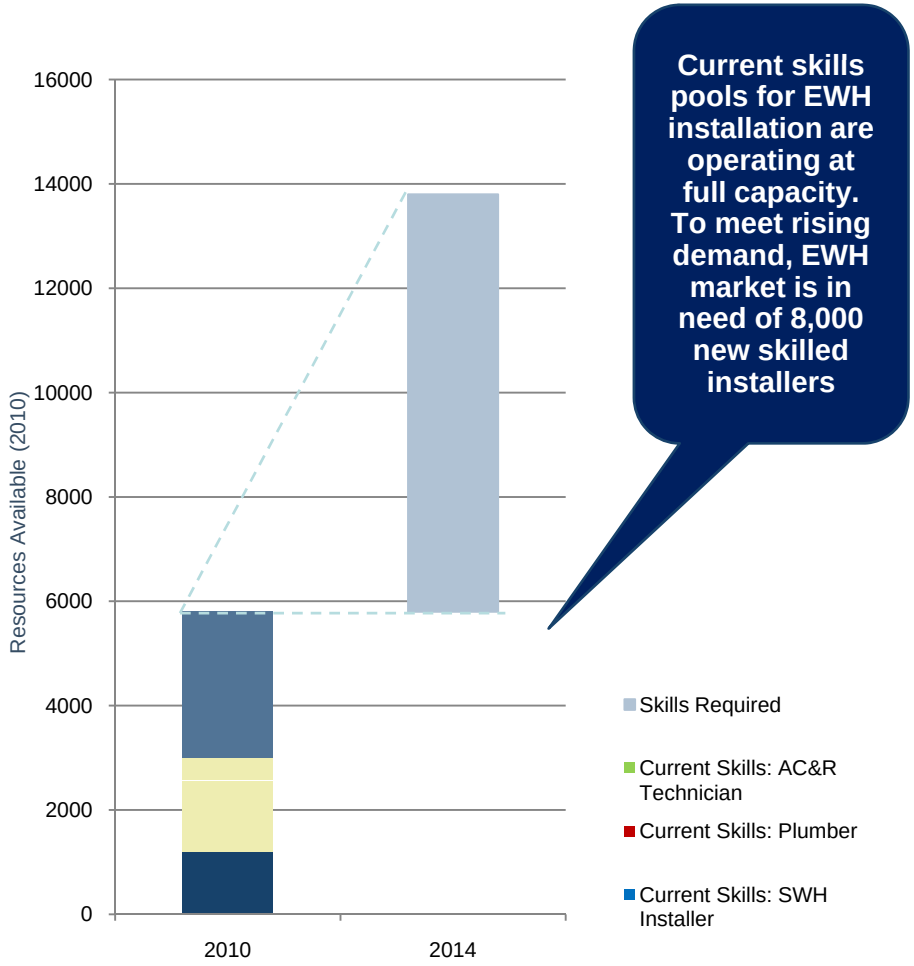
Skills Shortage

- The most labour-intensive is installation, followed by manufacturing
- Research indicates that of the labour force currently existing in the industry is segmented as follows:
  - 47% Installation
  - 27% Manufacturing
  - 26% Sales, distribution, administration and miscellaneous
- Research indicates lack of installation skills needed to handle growth in market
- SWH can be 4x as labour-intensive as a conventional geyser\
- Unique SWH skills needed

Segmentation of Labour Force in South Africa for the SWH Market, 2010

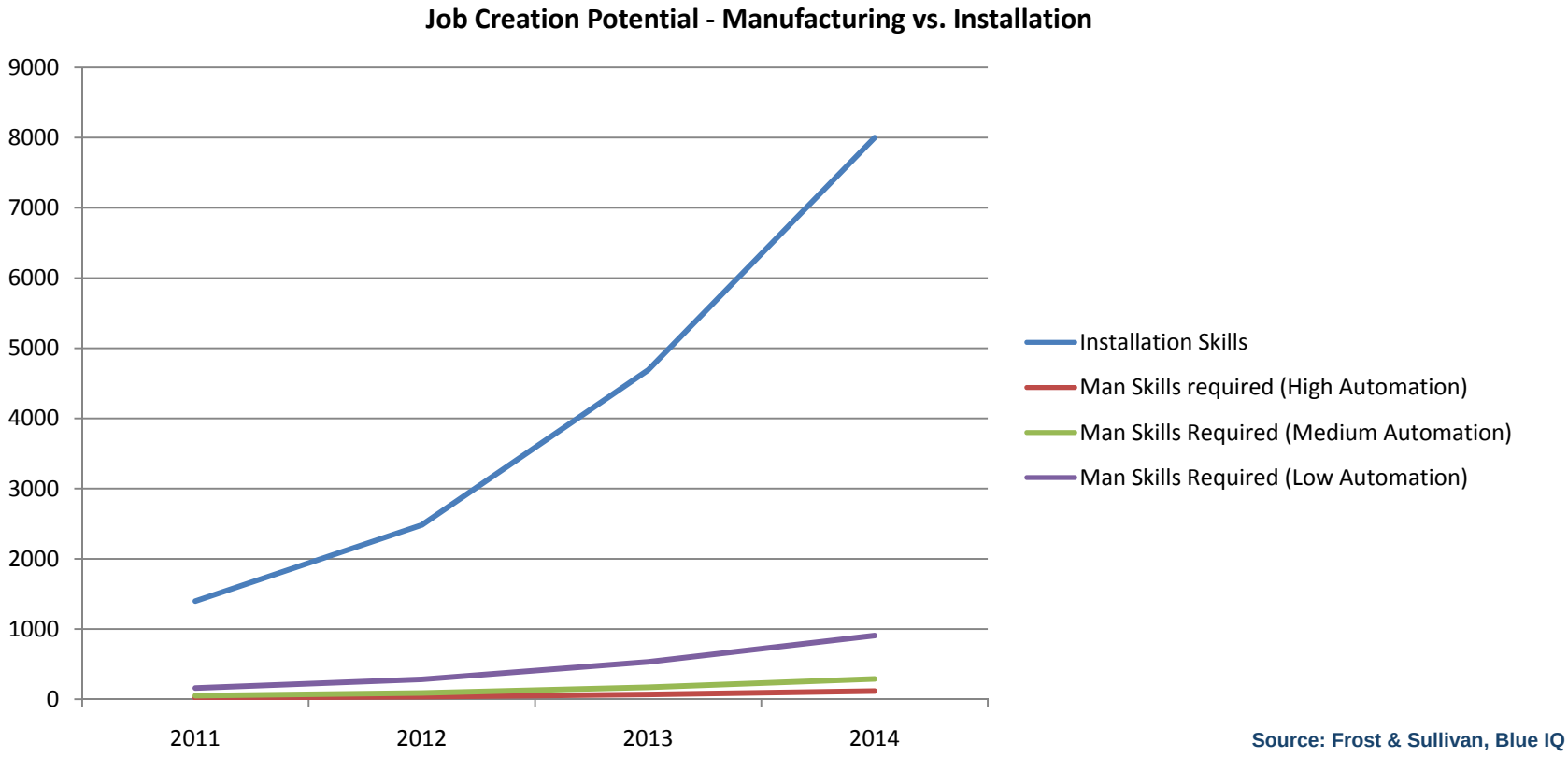


Source: Frost & Sullivan, Blue IQ



Current skills pools for EWH installation are operating at full capacity. To meet rising demand, EWH market is in need of 8,000 new skilled installers

International Benchmarking



Source: Frost & Sullivan, Blue IQ

Manufacturing skills decreases after a certain threshold due to levels of automation, while installation skills is directly linked to the number of systems

International Benchmarking

City of Barcelona

- The City of Barcelona has unrolled what is considered the most effective global benchmark of SWH by a range of industry experts
- Came into effect in August 2000
- The ordinance requires all new buildings, those undergoing a complete refurbishment or changing their function, to have SWH account for a percentage of their hot water usage
  - This applies to residential, commercial and industrial buildings
- The ordinance was revised in 2006 to raise the solar share (up to 70%) and to expand the building scope by decreasing what would be excluded
- Unsatisfactory installation quality was one of the key challenges in the starting period in Barcelona
- Global benchmarking has shown this is often the case when solar ordinances have been passed

Installed Capacity	173,340 units (2010)
Strategy for Successful Implementation	All-inclusive Pre-mortem Continued flexibility for revision Ordinance flanked by public awareness Support by construction companies and architects Installers must sign a two year maintenance obligation
Lessons Learned	Quality of product, quality of installation, and sufficient number of installers need to be formulated at the initial take-off of the project Aftersales service and maintenance plans are paramount to combat teething problems with quality of product and installation

International Benchmarking

City of Barcelona

- As the Barcelona model unfolded, it was noted that initially SWH were ordered by construction companies that had little or no motivation to choose higher quality products than what was strictly required by the wording of the regulation; once these buildings were solved or rented, these companies did not benefit from the energy savings
  - Their main goal was to keep down the investment costs, treating SWH like any other building component
- A key success factor of the Barcelona Ordinance was the lengthy consultation process and pre-mortem, which entailed a thorough debate involving: constructors; building administrators; architects; engineers; installers; consumers and tenants; as well as the local, regional and national energy agency and the public bodies responsible for housing, urban planning, protection of architectonic heritage and environment
  - This pre-mortem entailed flexibility and a debate that facilitated the correct implementation of the ordinance
- In less than five years, Barcelona multiplied its SWH use per capita by twenty times
  - The market was able to rise up to meet demand, due to the time lag between building plan passed and actual installation
  - A large number of installers, architects and building engineers were trained and gained practical experience with SWH technology
  - The construction companies became accustomed to include SWH from the earliest stage of planning, thus reducing the time and costs needed to integrate it at a later point
  - Citizens and potential users were informed about solar
- The Barcelona model was deemed so successful it has been used in over 60 Spanish cities, including Madrid and Sevilla, as well as internationally in Sao Paulo and Rome

International Benchmarking

Quotes from the Barcelona solar experience

- *"The introduction of this regulation gave rise to numerous debates and protests. In particular, it was necessary to win over the various actors in the construction sector (architects, builders, investors, etc.). The most difficult group were the investors, who were not entirely convinced of the wisdom of such a choice, nor of the reliability of the technology. "* **World Energy Council**

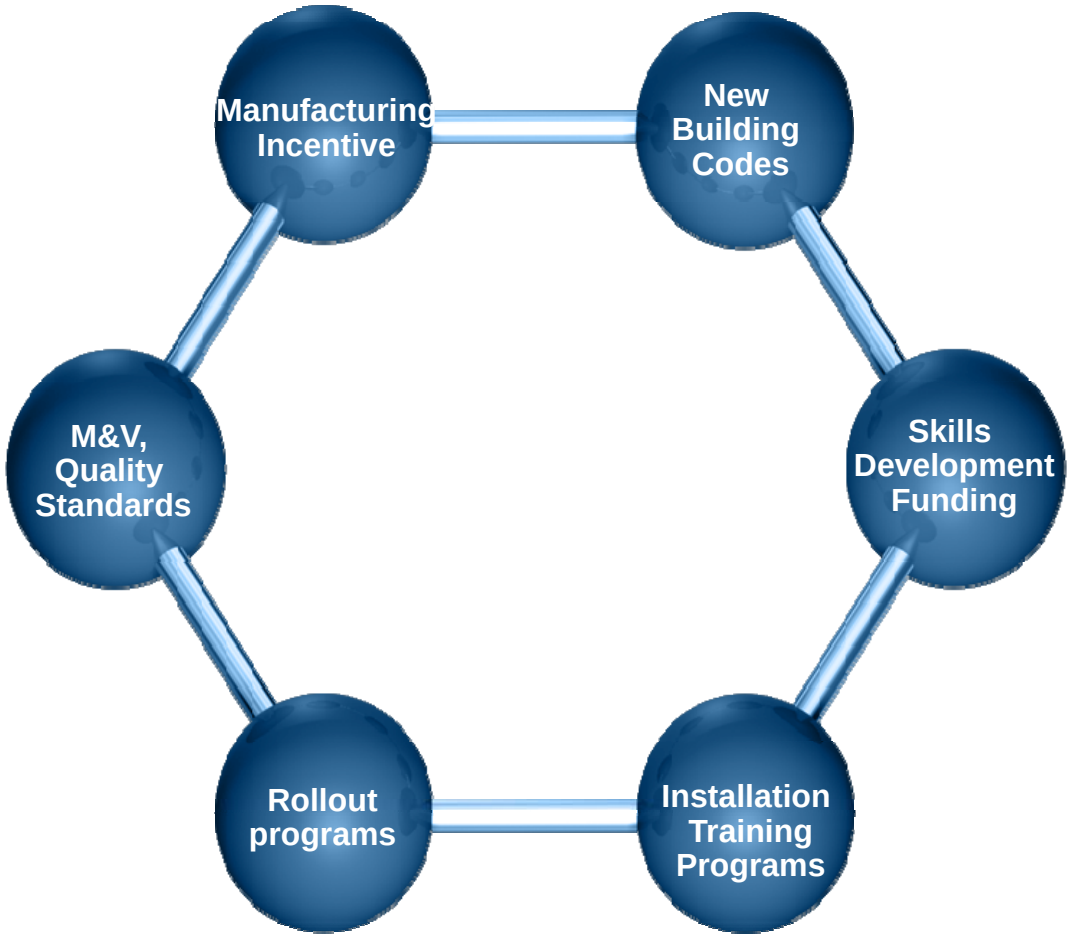
- *"They were also concerned about the possible impact of the extra cost of solar installations on the construction market, and especially any extra time that might be needed to obtain equipment that was not readily available. Finally a moratorium of several months was allowed before the regulation was enforced to give everyone time to adjust to the new requirements. This is an example of a regulatory decision applicable across the board and which was drawn up with the general agreement of all the stakeholders."* **World Energy Council**

- *"The extra investment incurred by the Ordinance is estimated to be 0.5%-1% in building work and materials (Stirzaker P., 2004). This extra-investment may be financed by interest-free credit arrangements available from IDEA and the public credit institute, Instituto de Crédito Oficial (ICO). The credit backs up to 70% of total investment (Ibid.)"* **Barcelona Energy Agency**

- *"Even with such financing arrangements, reaching a consensus with all the stakeholders involved in the construction sector was essential to the success of the ordinance. Property developers, construction companies, architecture colleges and installation contractors have all been closely associated to the construction and implementation of the regulation. Nevertheless, a 18-month moratorium has been introduced for all the sectors to prepare for the new regulation and for installers to gain statutory certification. In parallel, the standard certification of solar systems and installation has been developed in order to prevent the installation of low quality equipment as a result of the ordinance. The City of Barcelona has also implemented a broad communication program and organised periodic round tables in order to promote and facilitate the acceptance of the Ordinance."* **Barcelona Energy Agency**

Key Findings and Recommendations

Key Success Factors for Policy-makers



- For a EWH strategy to be effective, flanking measures should be in place from all sides to support the market.
- Currently, the existing rebate program needs the multilateral support of mandatory building codes, and enhanced M&V and quality assurance for products and their installation
- Funding needs to be released for skills development particularly in installation, where research has indicated significant job creation potential that is imperative for the success of transformation of the SWH market