

A systems modeling approach to Project Management: The *Green Islands* case study

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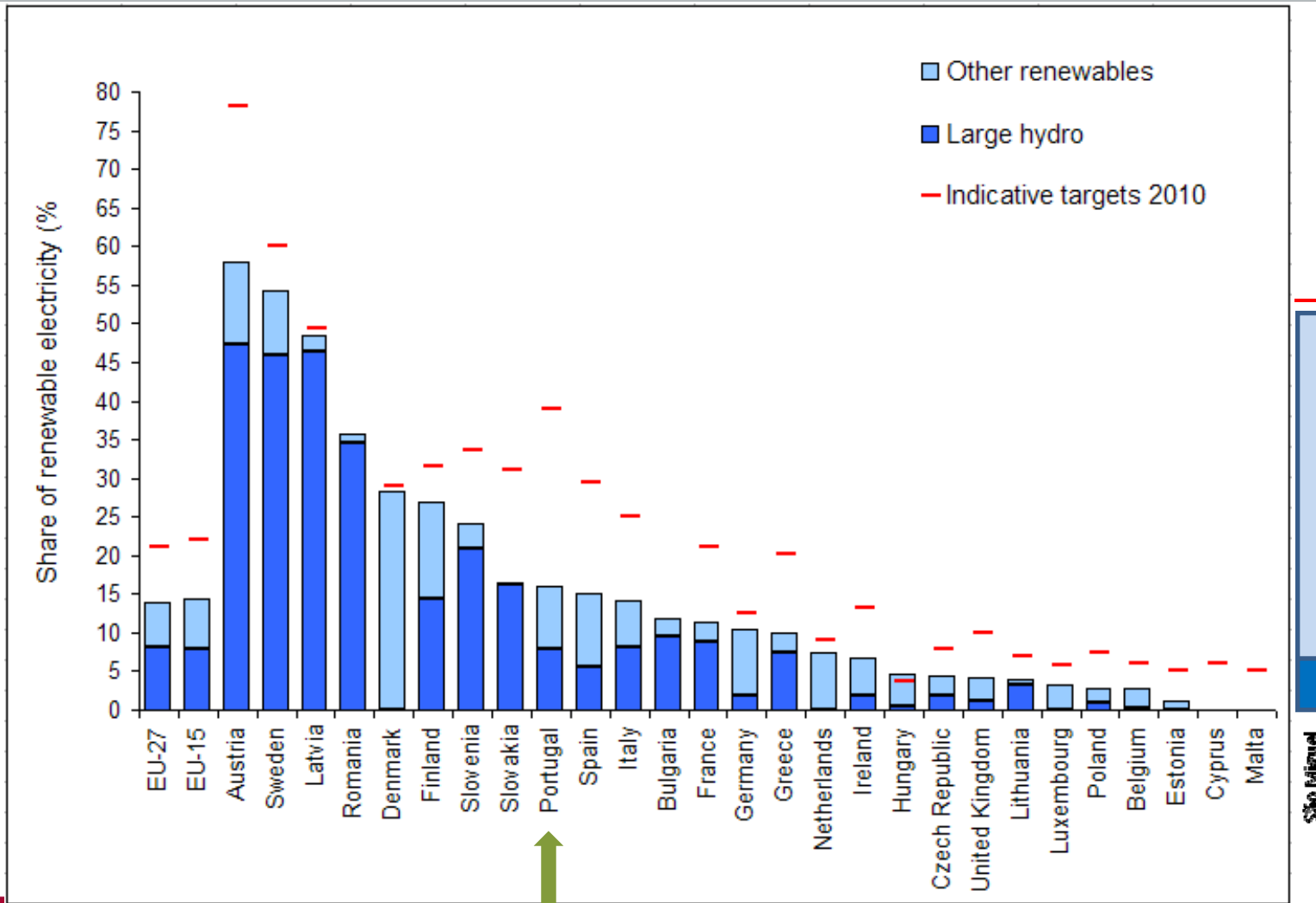
São Miguel	
Area	759 km ² (32%)
Population	150 000 (60%)



Lagoa Sete Cidades, São Miguel

The energy system in São Miguel

(... as perceived by the Azores local agents)



Energy Strategy for 2018

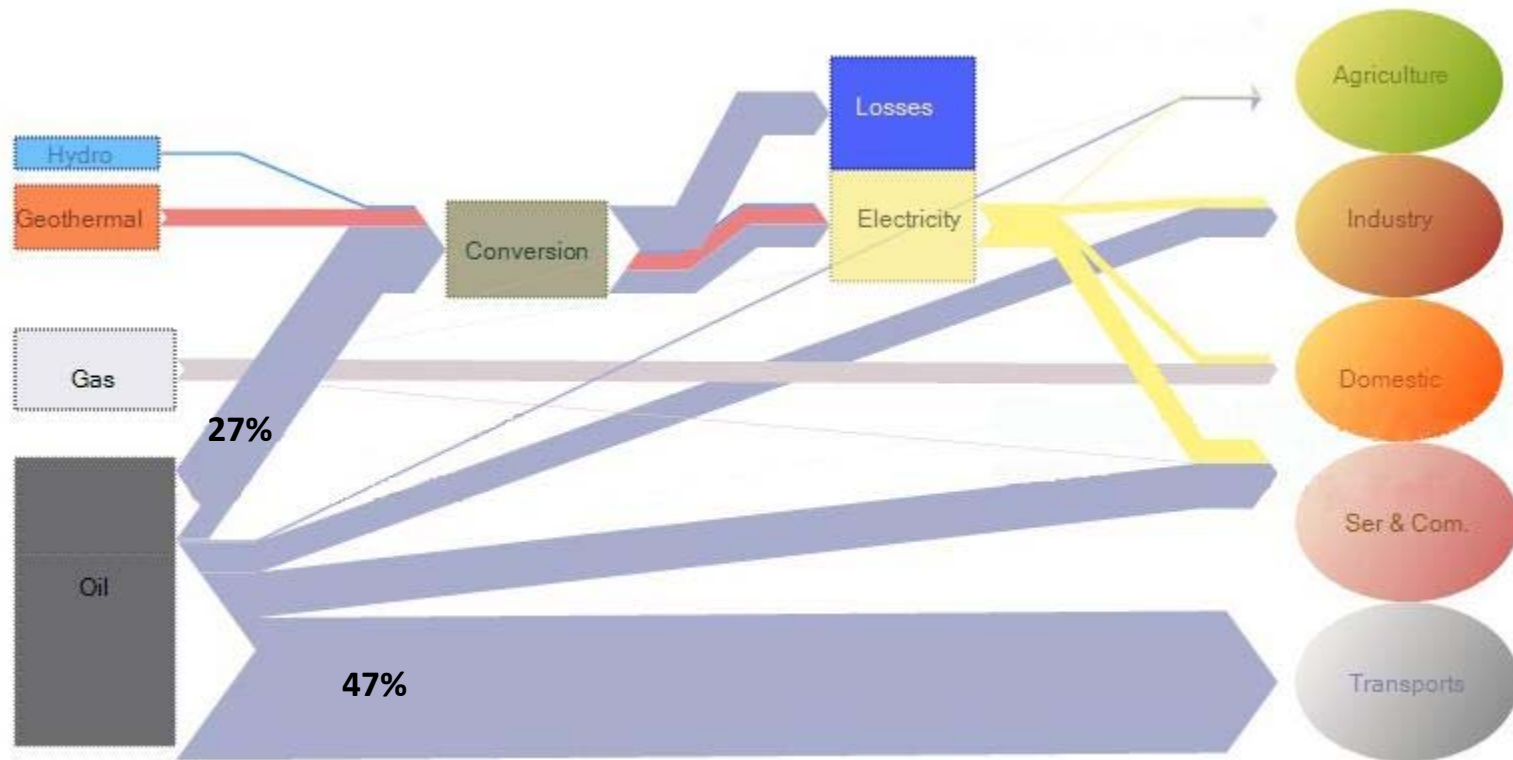
- Goals for all Azores
 - 75% of renewables on electricity production
 - 40% of renewables on primary energy (electrification of other sectors)
- Plan (for São Miguel)
 - 3MW Geothermal by 2010
 - 9MW Wind by 2011
 - 10MW Geothermal by 2013
- Questions
 - Another 10 MW Geothermal after 2013?
 - Storage system?
 - How to use biomass?
 - Is this enough? What else?



Green Islands Project

The energy system in São Miguel

(... the real system in 2007)



Two distinct visions for the project

Local Agents

- Renewable energy penetration
 - Power plants
 - Electrification of cooking and heating in households

- It is possible to achieve 75% of renewable penetration in electricity by 2018

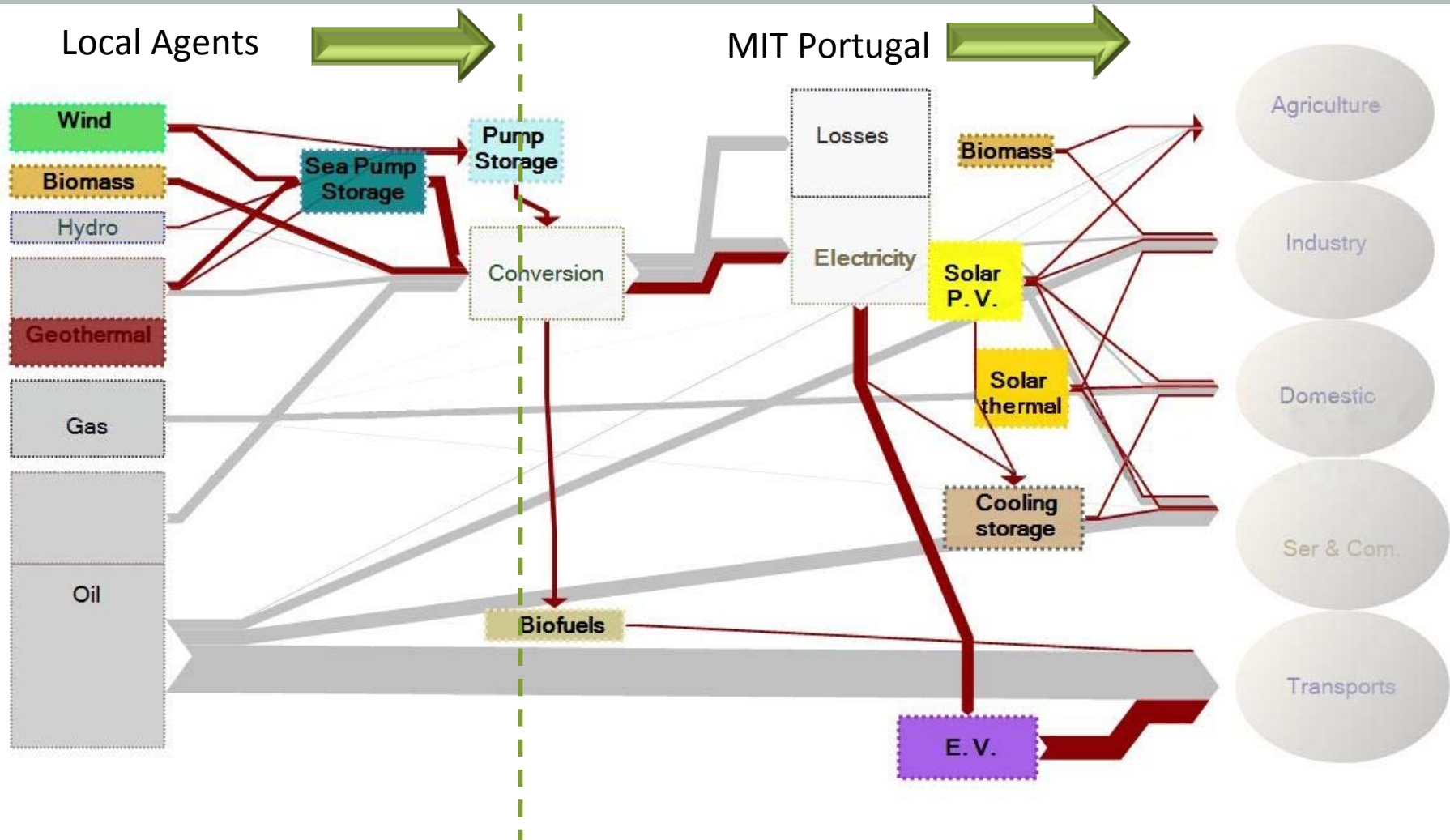
...but then what?

- It is impossible to achieve 40% of renewable in primary energy by 2018

MIT-Portugal Program

- Renewable energy penetration
 - Power plants
 - Electrification of transportation
 - *Patrícia Baptista et al*
- Energy Efficiency
 - Transportation fleet renovation
 - *Patrícia Baptista et al*
 - Household consumption
 - *Richard Larson et al*
- Modernize networks
 - Smart grids
 - *Richard Larson et al*
 - Storage systems

Strategy for 2018



Green Island Project

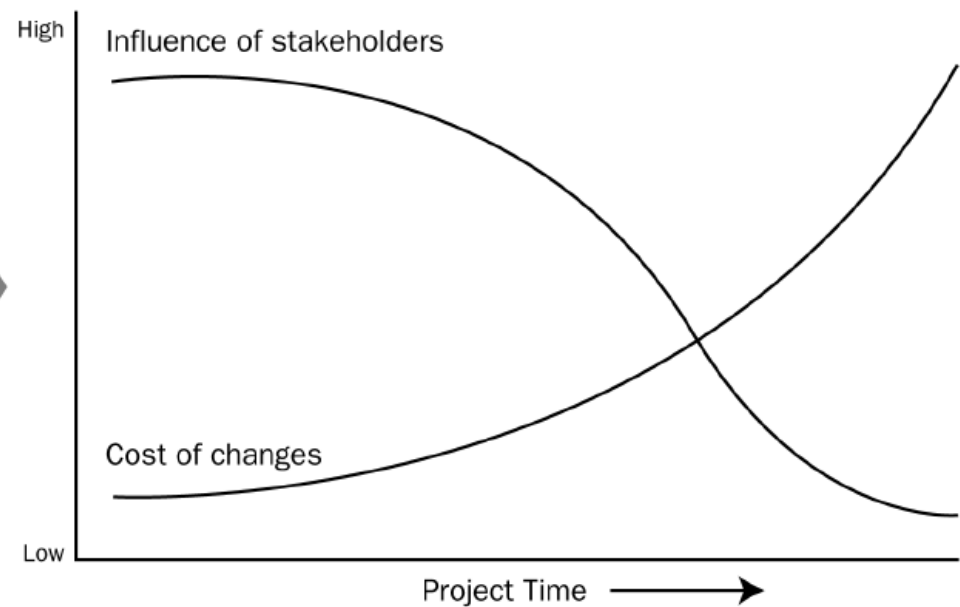
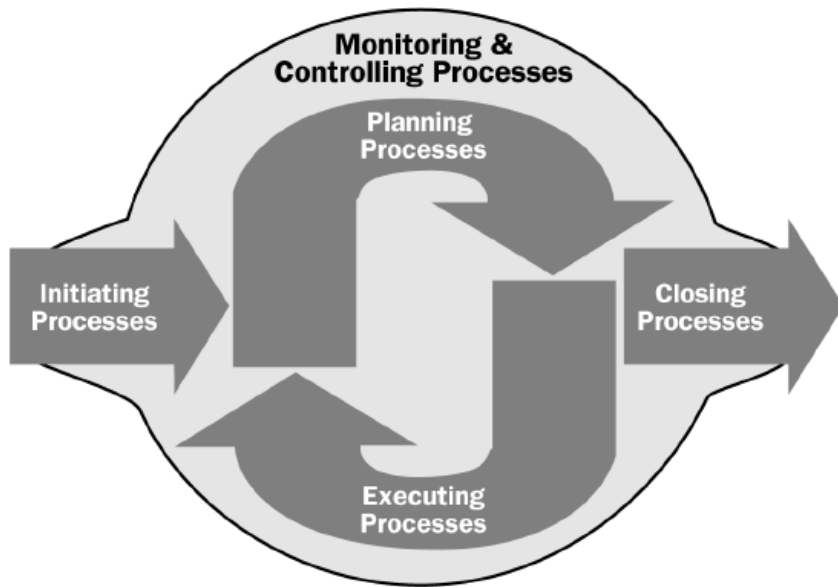
- Engineering Systems Problem
 - Technical dimension
 - Storage / Smart Grids/ Electric Vehicles / Biomass
 - Economic dimension
 - EU or PPP / Energy markets
 - Social dimension
 - Acceptance / Behavior Changes / Politic-Economic Power
 - Critical Infrastructures
 - Energy /Transportation /Communication
 - Energy and Sustainability
 - Safety /Security
 - Fundamentals
 - Complexity, Uncertainty...

Some quotes from yesterday

- Engineering the energy System in São Miguel
 - Subra Suresh:
 - “ES has to tackle the long-term social impact”
(we don't want to mess up the XXII century)
 - Olivier de Weck
 - “ Islands can be great laboratories for ES”
 - Joel Moses
 - “ Humans play an important role in ES”
- How to manage such an endeavor
 - Heinz Stoewer:
 - “Failure in project management...bad requirements”
 - “Emphasis should be on early phases”

Project Management

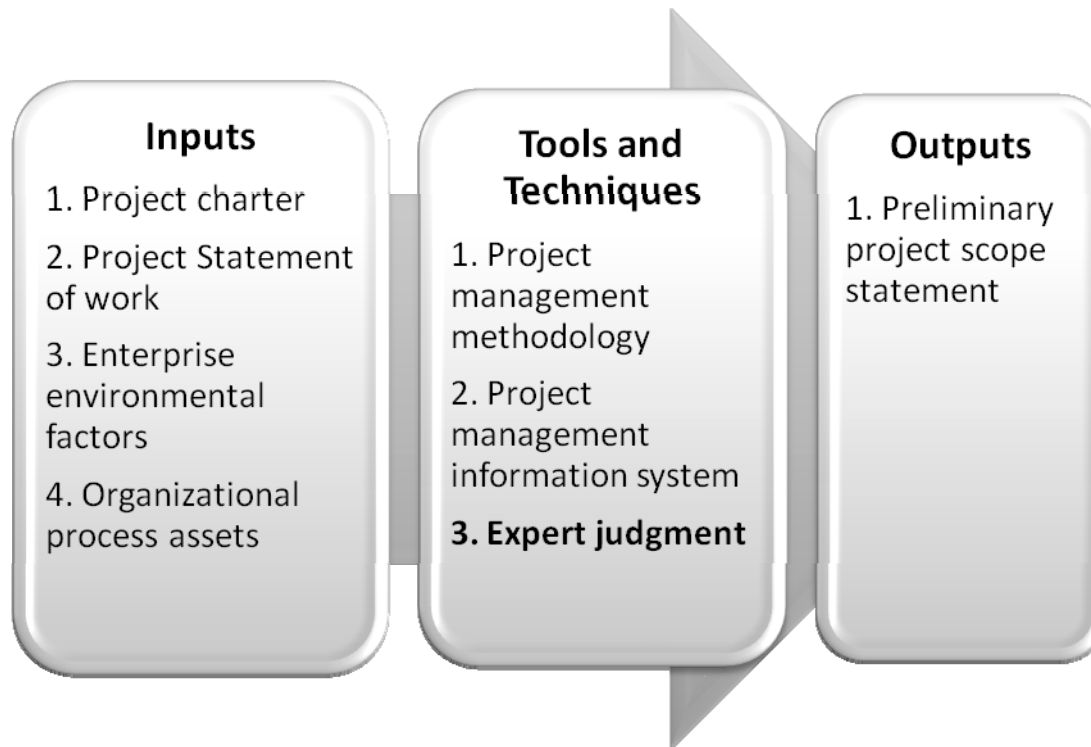
- Defining a correct scope as early as possible is important
- Defining a scope requires alignment between stakeholders



Source: PMBOK 3rd Edition

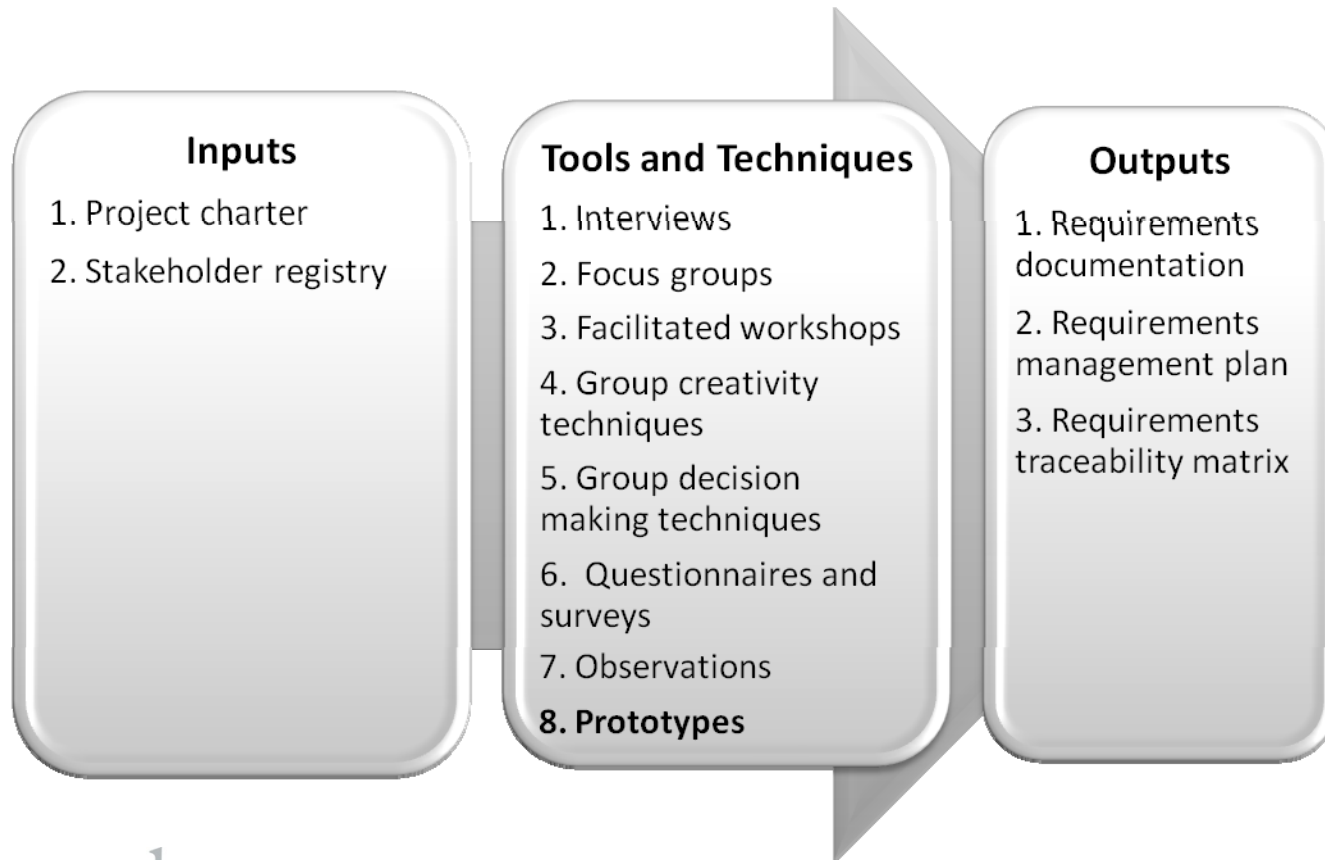
Defining a scope (PMBOK 3rd Edition)

Preliminary Scope Statement



Defining a scope (PMBOK 4th Edition, as of 2009)

Collect Requirements



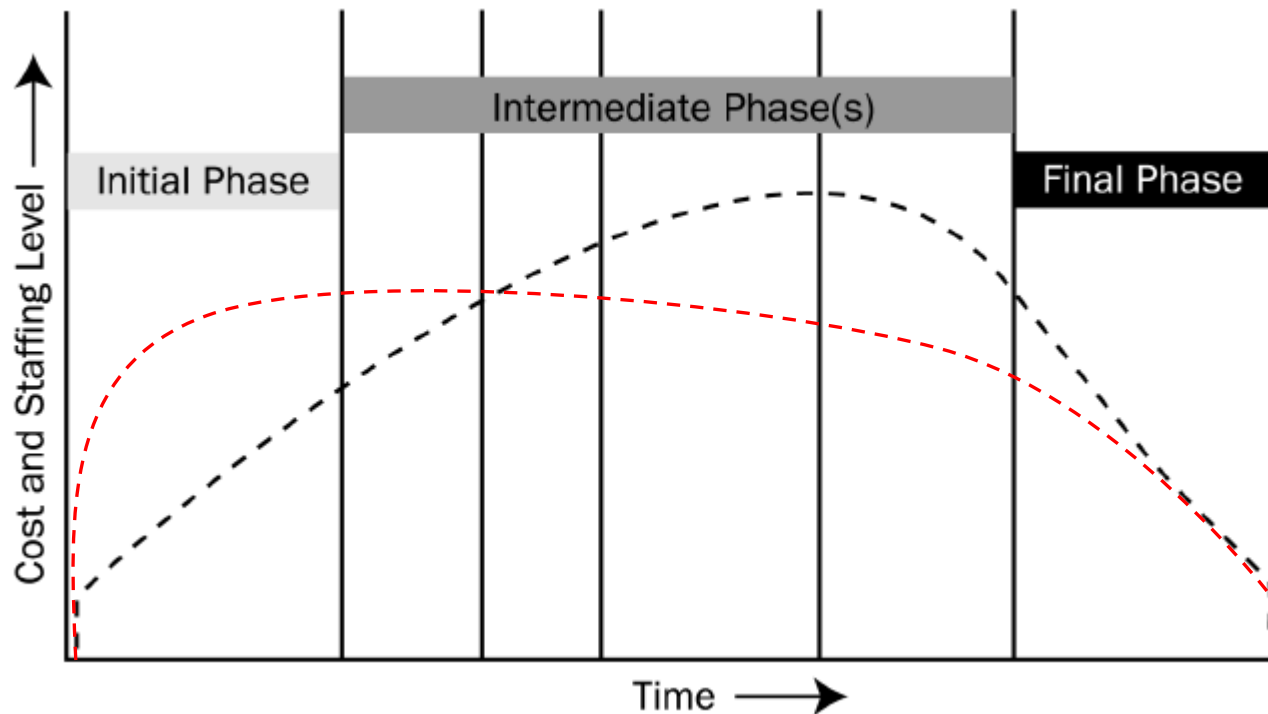
Systems model as prototyping tool

- Project Management as long been an holistic practice
 - It is easy to integrate new methods and tools
- Nowadays, there are models everywhere
 - Commercial softwares for specific domains
 - Energyplus, DERCAM, LEAP
 - General modeling tools and capabilities
 - Matlab

It saves a lot of time (cost, quality problems) if project team brings to the table of discussion the modeling tools at the beginning of the discussions with the customers

Implementation

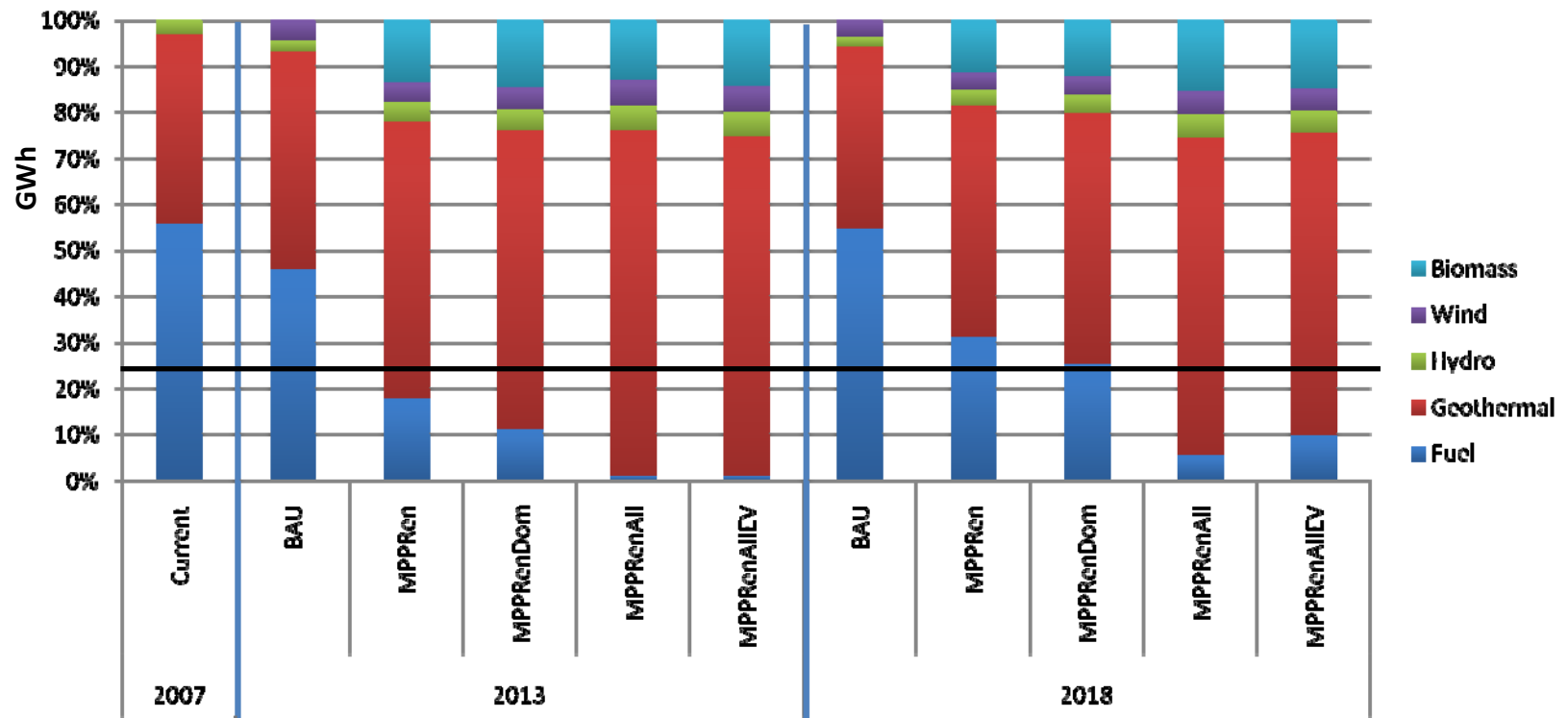
- The first task is to get data and build a model for scope discussion
- The total cost is the same or less
 - Spending more at the beginning will save costs on changes



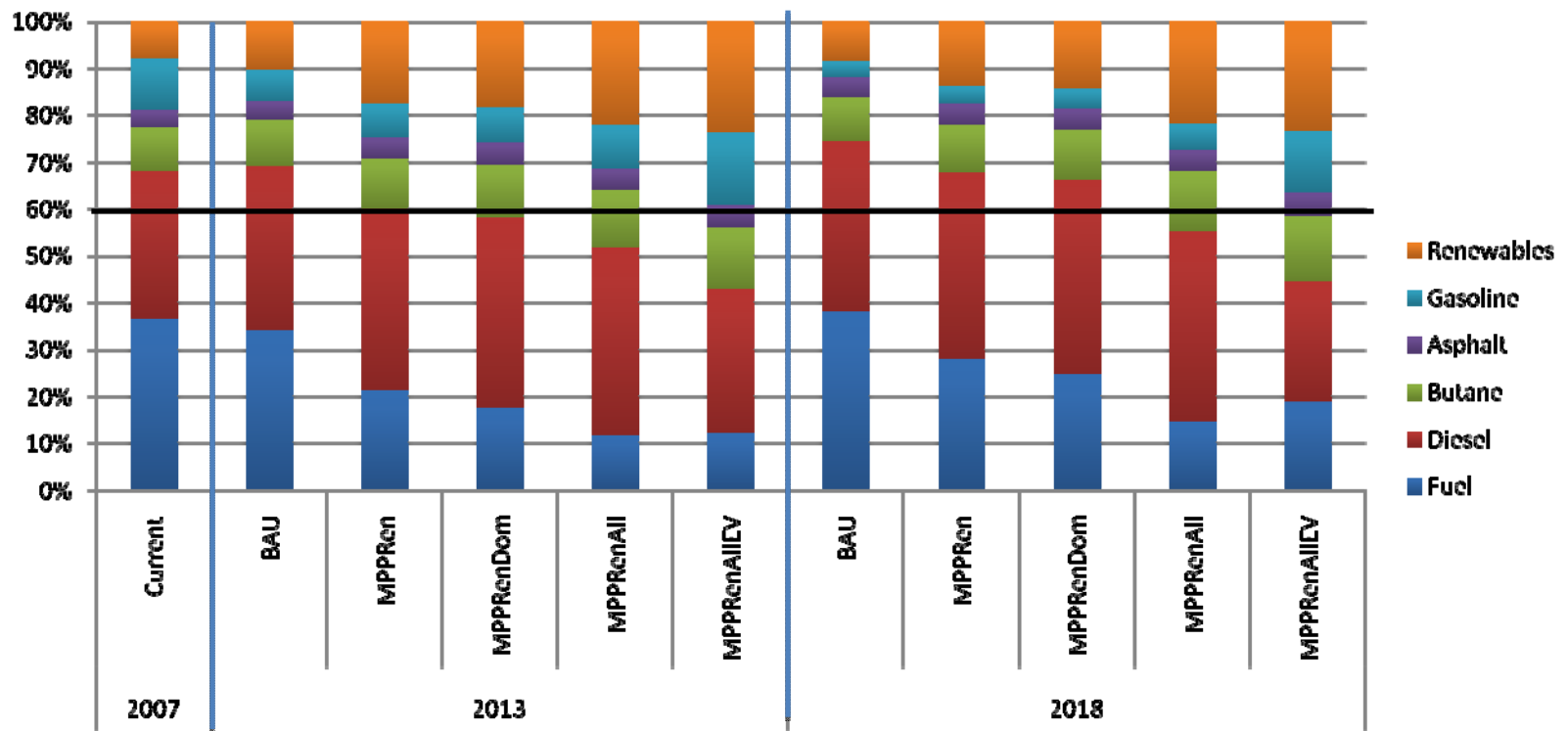
Green Islands Case: TIMES-MARKAL to build scoping scenarios

- **Business As Usual**
 - 37 MW Geothermal: [24 + 3 + 10] (2013)
 - 5 MW Hydro
 - 9 MW Wind (2011)
- **MPPRen (+ Renewables & Storage)**
 - 47 MW Geothermal: [24 + 3 + 10] +10 (2013)
 - 9 MW Hydro [5+4]
 - 9 MW Wind (2011)
 - 10 MW Biomass (2013)
 - 15 MW Pump-Storage (2013)
- **MPPRenDom (+ Household Efficiency)**
 - Energy Efficiency Gains from New Appliances
 - Electricity Demand Growth 2%
- **MPPRenAll (+ Lower demand growth)**
 - Non-Electric/Non-Transportation Demand Growth 1%
- **MPPRenAllEV (+ Introduction of Electric Vehicles)**
 - 6% of Electric Vehicles in 2013, 30% in 2020

Electricity Production



Primary Energy



Results

- Only after the discussion of these scenarios it was possible to define what the necessary requisites were:
 - Much larger investments
 - More powerplants
 - Grid
 - Transports (fleet renovation or electric vehicles)
 - **Strong political intervention**
 - Efficiency policies
 - Transportation policies
 - Incentives and energy prices
 - **Research and Development effort**
 - Renewables dynamics
 - Consumer Behavior
 - Socio-characterization

Conclusions

- System modeling tools are out there to be used
 - Tools are easy to acquire
 - People know how to use them
- They should be brought to project management process in the scoping definition phase
 - Alignment between customer expectations and project team skills
 - Better understanding of requirements
 - Project will deliver what was asked...and what was needed
 - Better planning and consequently better budgeting and scheduling and quality