

# A Systems Perspective on Low Carbon Technologies

Jörg Lalk



I keep six honest serving men  
(they taught me all I knew)  
Their names are What and Why and When  
And How and Where and Who

(Rudyard Kipling)



# Overview

1. What do we mean by
  1. “system”,
  2. “systems thinking” and
  3. Is there value in a systems approach?
2. What is wrong with current thinking?
3. Conclusion

Experience has clearly shown us that the development of a low carbon economy is a very complex systems engineering project. It requires the support of advanced science and technology and requires that the public generally recognize the need to conscientiously change their traditional patterns of production and consumption,

Source: Shilin Yi Project, *Qiushi*, No. 6, 2010



***....we do not try to cure a headache by brain surgery, but by putting a pill in the stomach. We do this because we understand how the body, a biological system, works. When science divides reality up into disciplinary parts and deals with them separately, it reveals a lack of understanding of reality as a whole, as a system.***

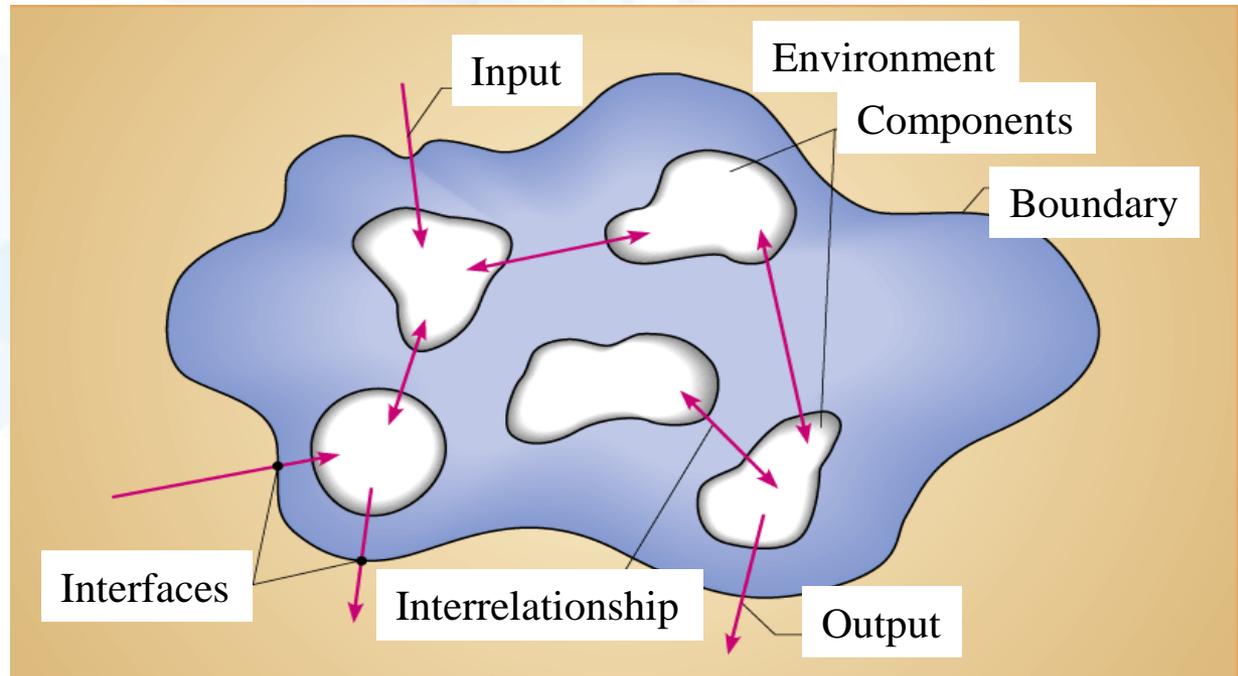
Russell Ackoff



# 1.1 What is “system”?

The Free Dictionary defines “system” as:

A group of interacting, interrelated, or interdependent elements forming a complex whole.



## 1.2 What is “systems thinking”?

*"Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static 'snapshots'... Today systems thinking is needed more than ever because we are becoming overwhelmed by complexity. Perhaps for the first time in history, humankind has the capacity to create far more information than anyone can absorb, to foster far greater interdependency than anyone can manage, and to accelerate change far faster than anyone's ability to keep pace."*

Peter Senge, The Fifth Discipline



# HOLISM AND EVOLUTION

BY  
GENERAL THE RIGHT HON. J. C. SMUTS

MACMILLAN AND CO., LIMITED  
ST. MARTIN'S STREET, LONDON  
1927

*“...in the last resort a civilisation depends on its general ideas;...”*

*“Holism is in its own way a groping towards the new light and to new points of view.”*

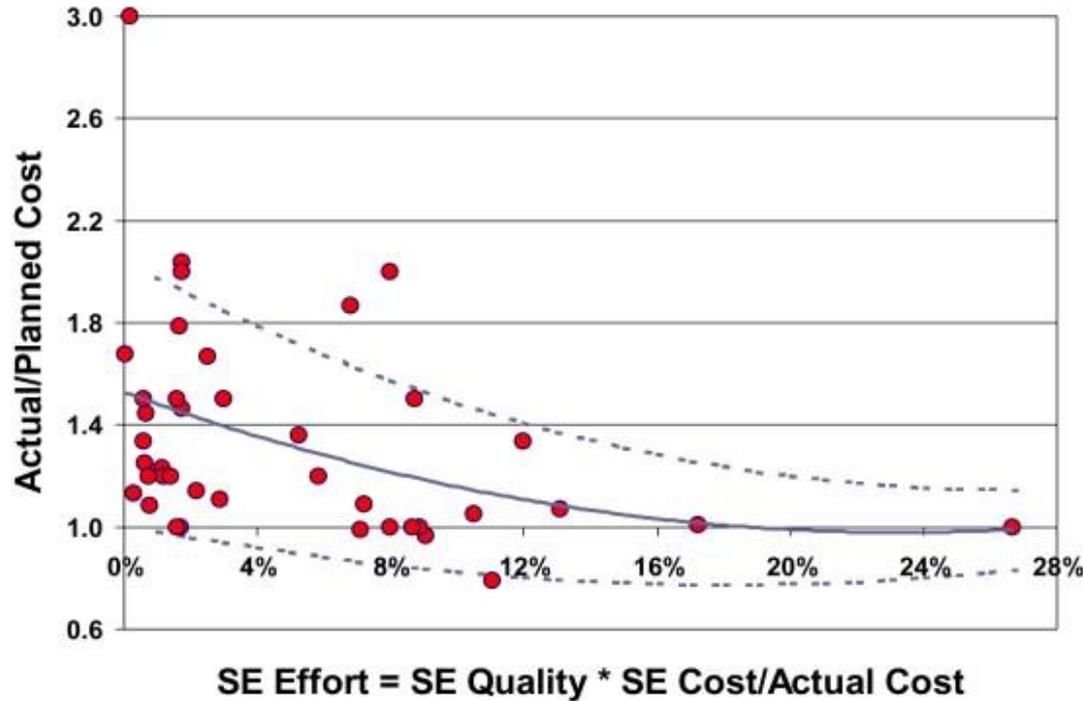
*“There is no question that in our age there is a good deal of turmoil about the manner in which society is run. Probably at no point in the history of man has there been so much discussion about the rights and wrongs of policy makers.....(citizens).... begun to suspect that the people who make the major decisions that affect our lives don’t know what they are doing....They don’t know what they are doing simply because they have no adequate basis to judge the effects of their decisions.”*

C. West Churchman, “The Systems Approach”, 1968

**Question: Has anything changed?**



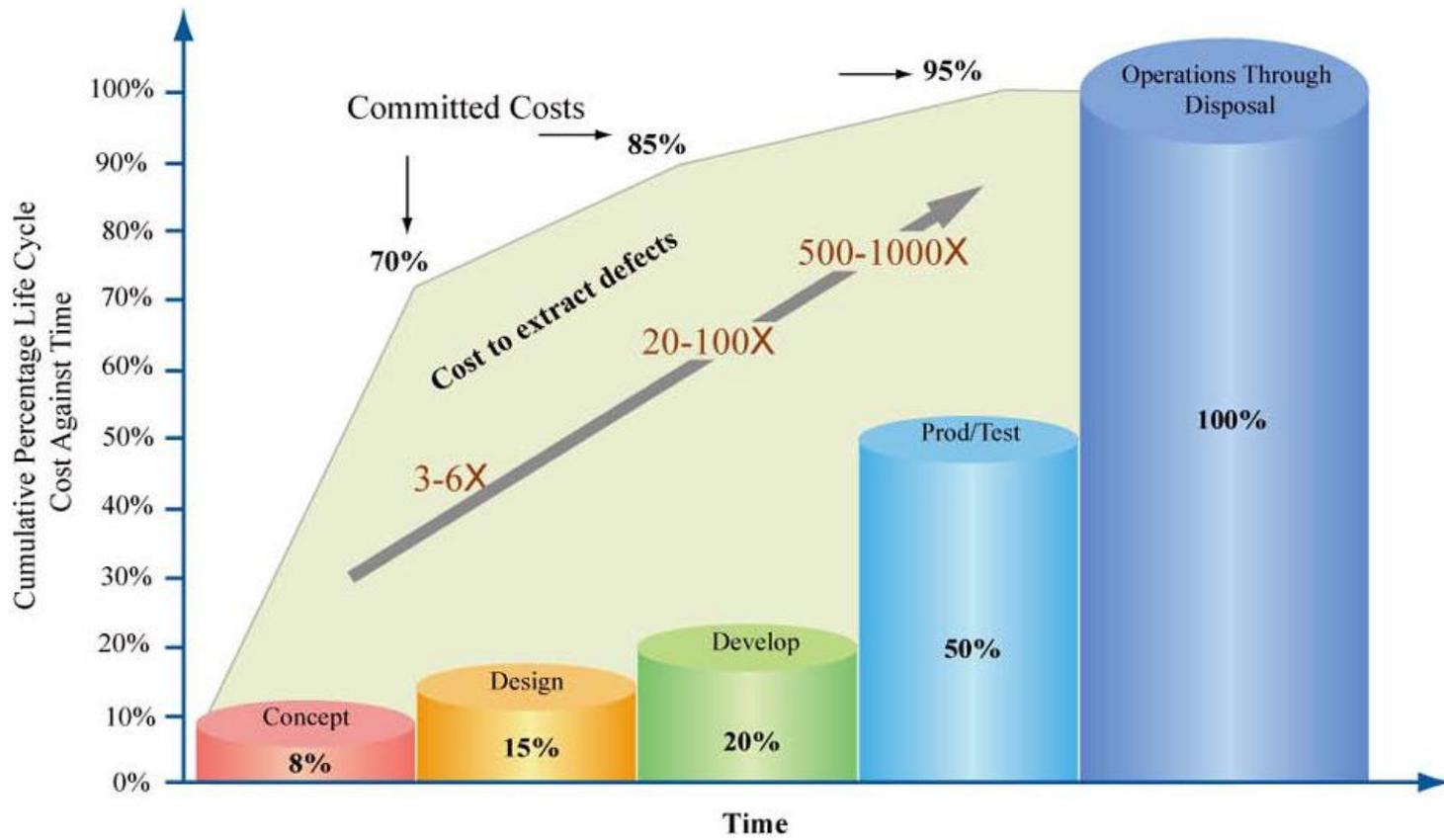
## 1.3 Is there value in a systems approach?



- A number of studies by NASA and MIT provide evidence that both cost and risk increases substantially if a systems approach is not followed....
- Other studies (Standish) shows that the use of little or no systems approach typically leads to majority of projects not achieving most technical requirements

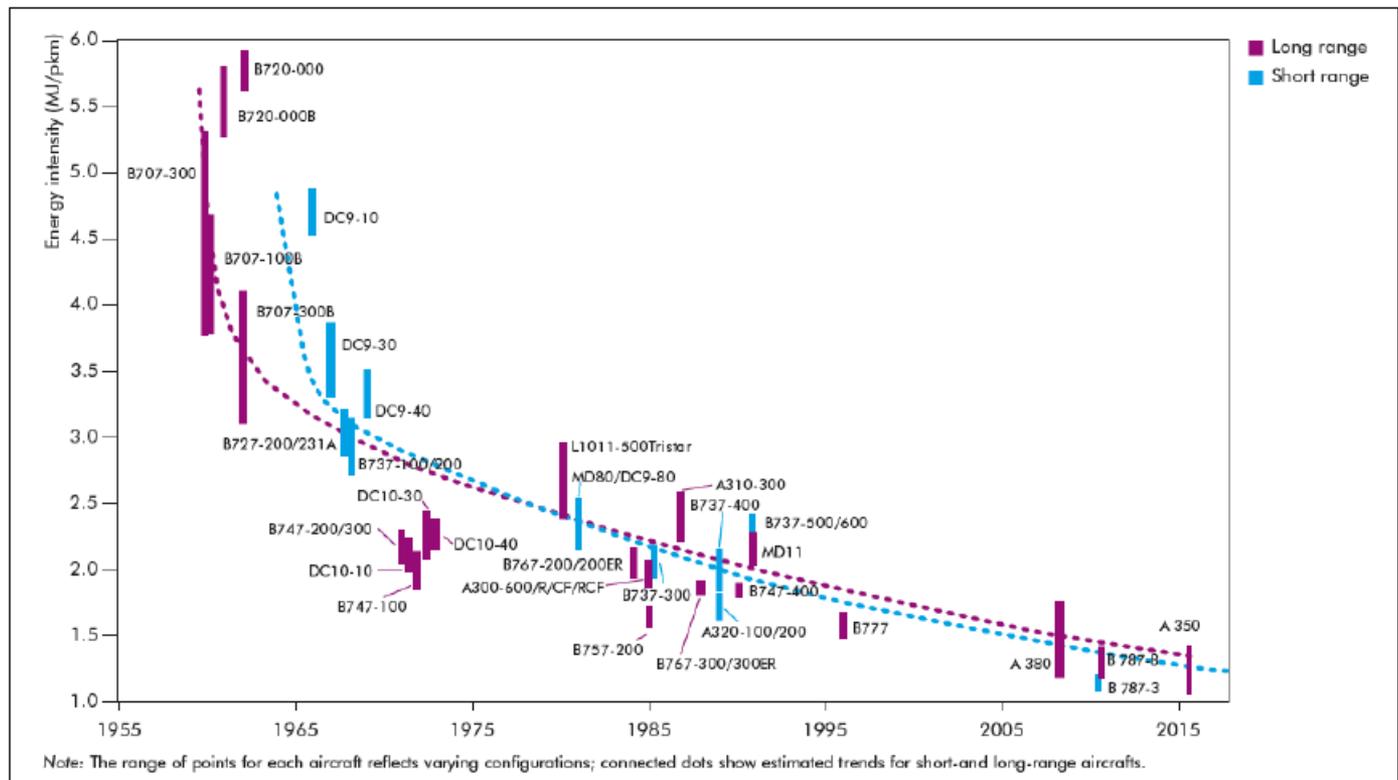


- Proven fact that it is better to spend substantial time in understanding the problem first
- Any subsequent changes to policy, chosen technologies, etc. costs more



## 2. What is wrong with current thinking?

- We tend to think “small picture”
- Usually driven by our own personal likes/dislikes, current fads, etc.
- Typical example can be found in fuel efficiencies of modern jetliners (impacts emissions per seat)

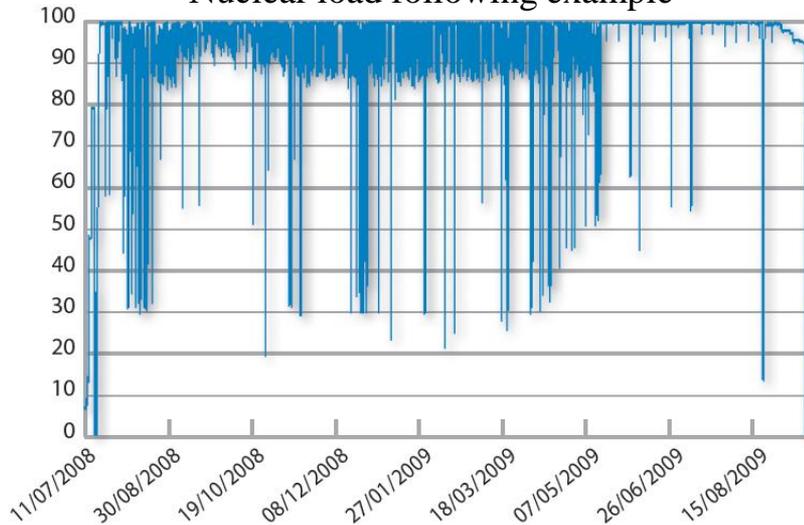


Source: IEA (2009)



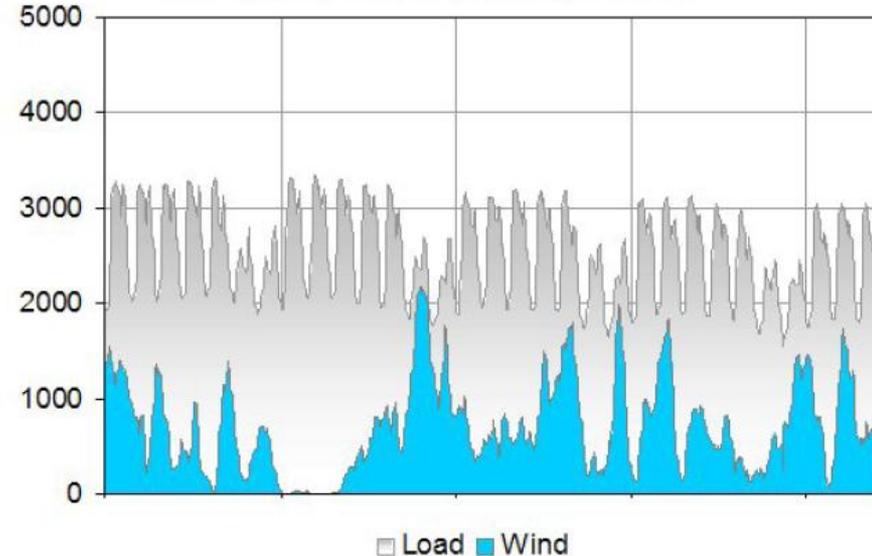
- We tend to play off one energy source against another (e.g. coal vs. wind vs. solar vs. coal vs. gas vs. hydro vs. bio....
- In doing this we miss the big picture (we need all resources for some very valid reasons, e.g. nuclear provides baseload, wind does not; solar & wind cannot provide load following, coal, nuclear & hydro can, wind & solar is very suitable for smaller off-grid use, and so on....

Nuclear load following example



Source: EDF

DKW - Load and Wind Power - March 2010



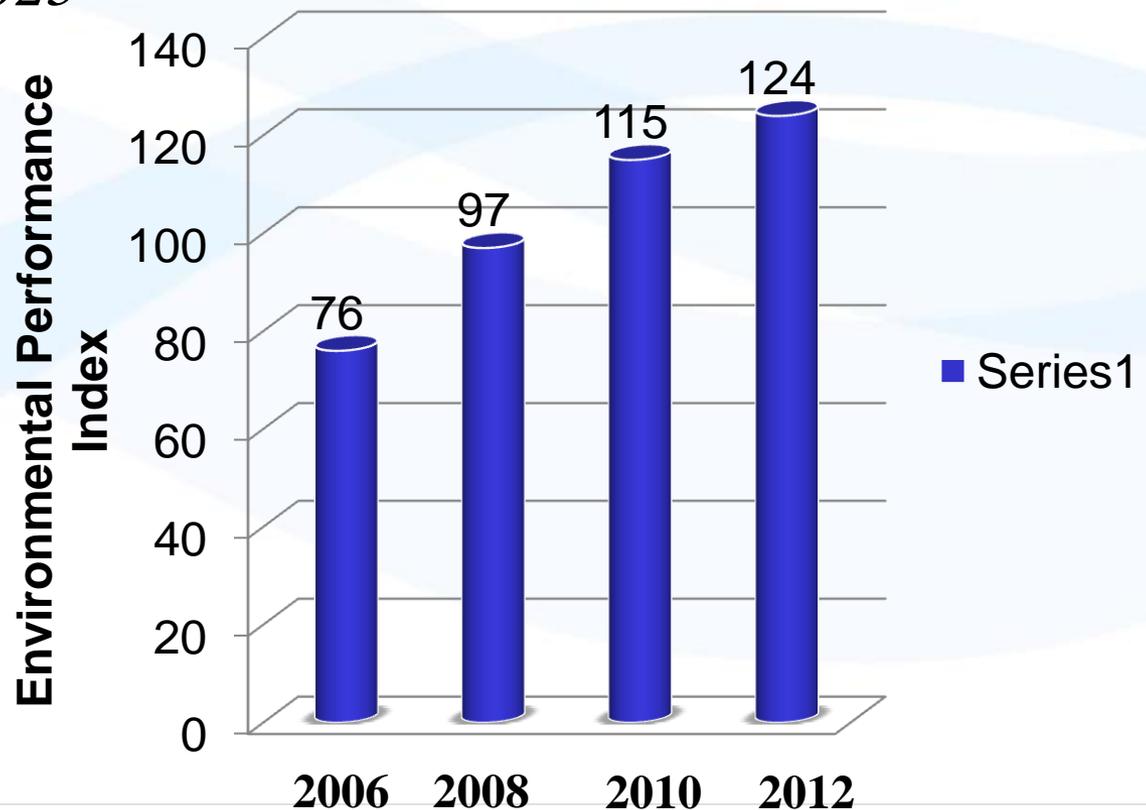
Source: Bach, 2011

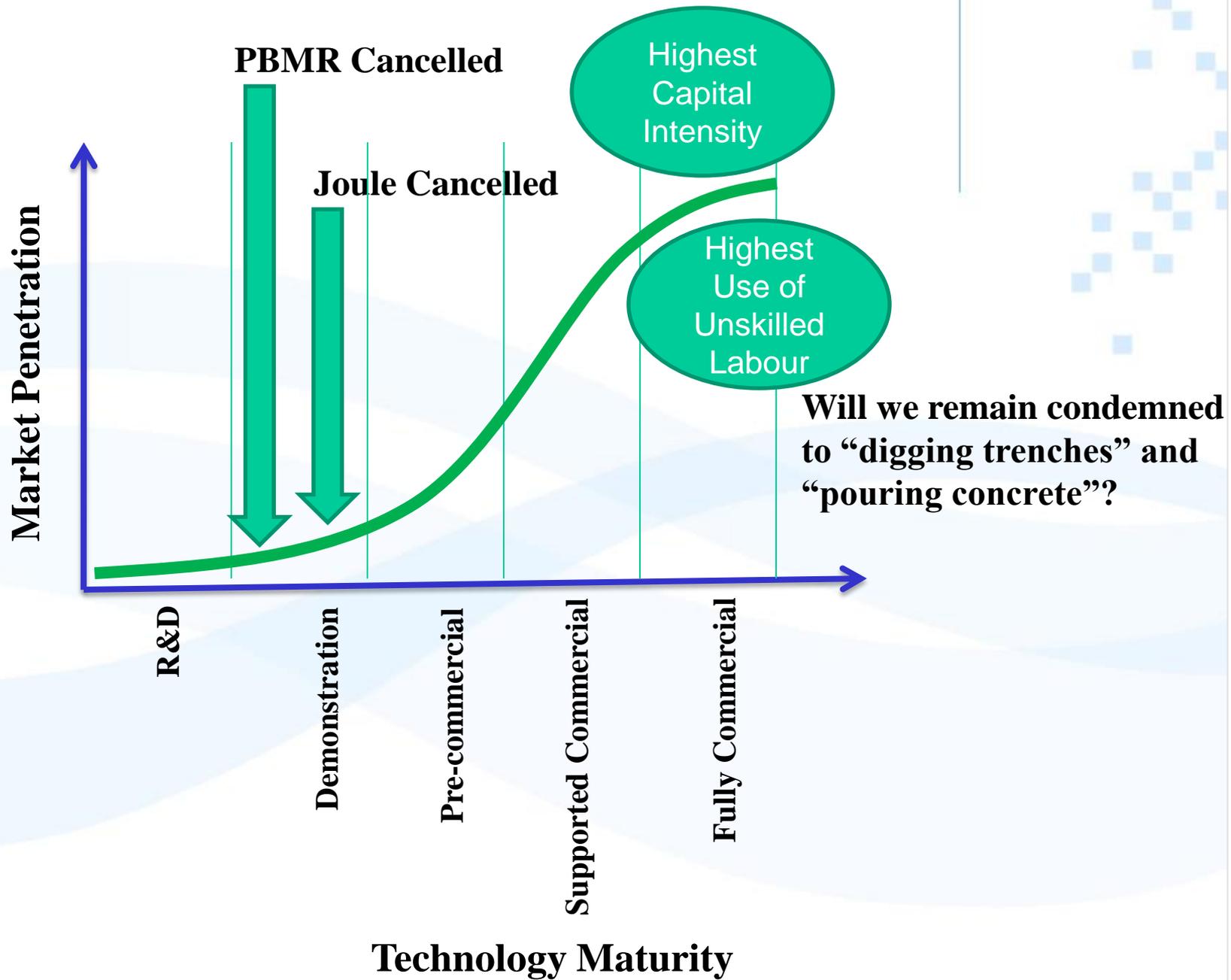


From the 2012 NDP, Chapter 5, pp179:

*“South Africa has taken major steps to formulate and implement measures to adapt to and mitigate climate change. These steps are informed by the country’s commitment to reduce its emissions below a baseline of 34 percent by 2020 and 42 percent by 2025”*

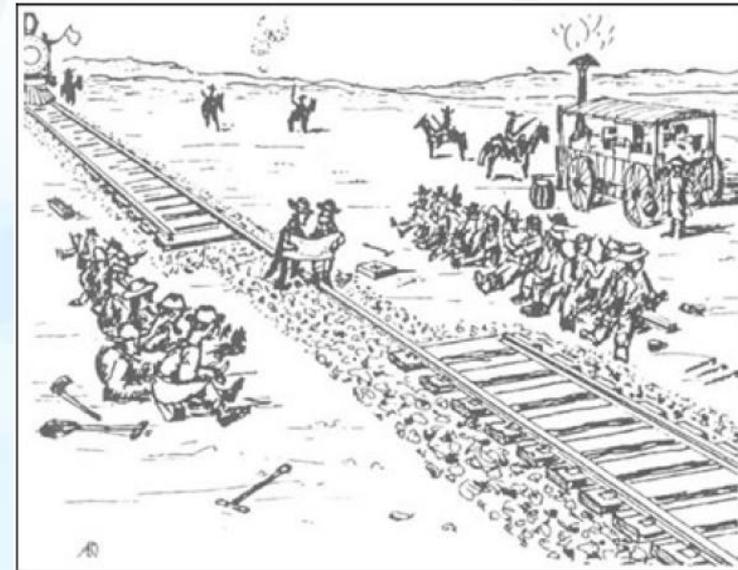
2012 Yale EPI report lists South Africa as one of the worst decliners





### 3. Conclusion

- The power of systems thinking comes from a focus on systemic structures, which is where the greatest leverage for problem solving and positive change lies.
- A systems approach can help shed light on current problems—especially those that seem to continually repeat—by viewing them from a different perspective.
- Systems approach offers a range of tools for gaining deeper insight into problems.



# thank you

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