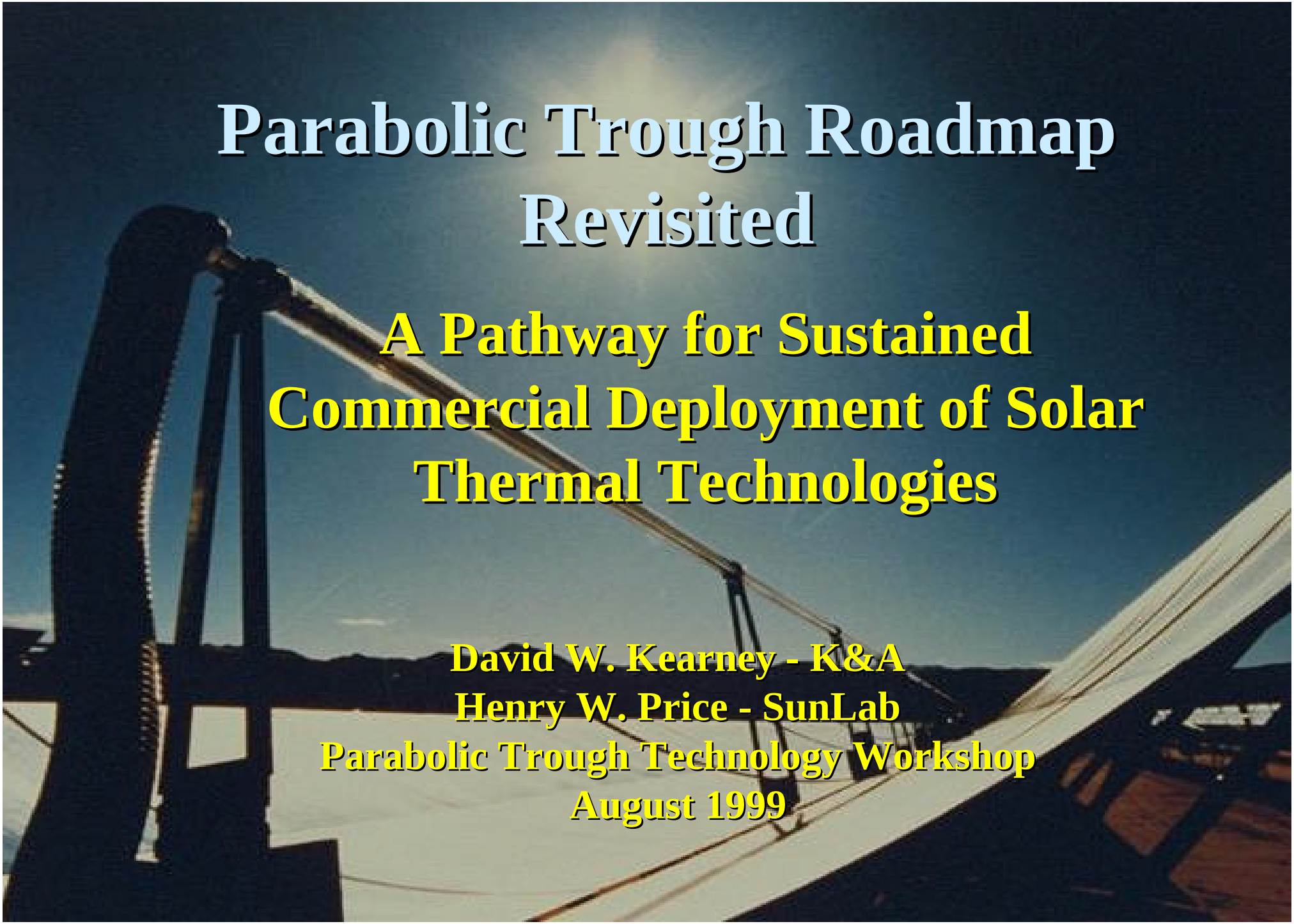


Parabolic Trough Roadmap Revisited

A Pathway for Sustained Commercial Deployment of Solar Thermal Technologies

David W. Kearney - K&A
Henry W. Price - SunLab

Parabolic Trough Technology Workshop
August 1999

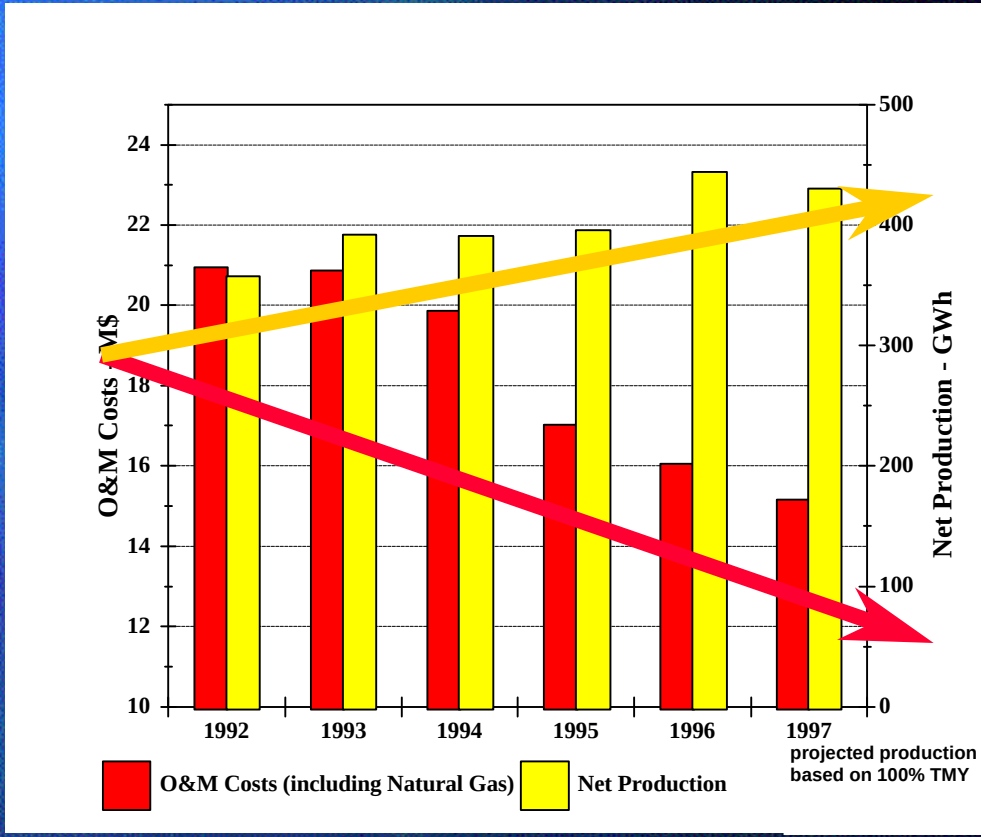
Trough Roadmap Working Group

January 1998 - Boulder, Colorado

- KJC Operating Co.
- Bechtel
- SOLEL
- Pilkington Solar Int.
- Industrial Solar Tech.
- The World Bank
- Former Luz Experts
- California Energy Commission
- DLR/MD-PSA
- Kearney & Assoc.
- SunLab - Sandia & NREL

Starting Point

- 340 MWe of installed trough power plants in California operating well
- > 100 plant-years of invaluable commercial experience
- Plants demonstrate good to excellent performance; or lower performance understood
- Limited R&D since ‘91 has shown excellent results
- LCOE ~ 15-18 ¢/kWh (1998$)



Active Project Development
50 - 150+ MWe
Steam Turbine Cycle or CT/ST Combined Cycle

- India Govt with GEF
- Mexico IPP with GEF
- Morocco IPP with GEF
- Crete IPP with EU
- Spain IPP
- Egypt IPP with GEF

April 1999 - GEF STAF Review Committee Recommended Parabolic Trough Technology for Consideration in Solar Thermal Projects

Marketing Targets and Goals

- Near-Term
  - High value/cost markets and opportunities
  - Intermediate load power needs
  - Niche markets, such as islands
- Long-Term
  - Competitive with conventional generation
- Influencing Factors
  - Competitiveness in power market
  - Global climate change needs
  - Fossil fuel price trends

Cost Reduction Opportunities for Parabolic Trough Power

15.7 ⇨ 5.5 ¢/kWh

- Technology Improvements
  - Demonstrated Improvements, Advanced Technologies, ISCCS
- Cost Reduction
  - Plant Size, Solar Power Parks, General Cost Trend in Power Equipment, Solar Property & Sales Tax Exemptions
- Cost of Capital
  - Low-Cost Capital, Risk Reduction
- Incentives
  - Investment & Production Tax Credits, Green Power Markets, Carbon Tax

Development Area:

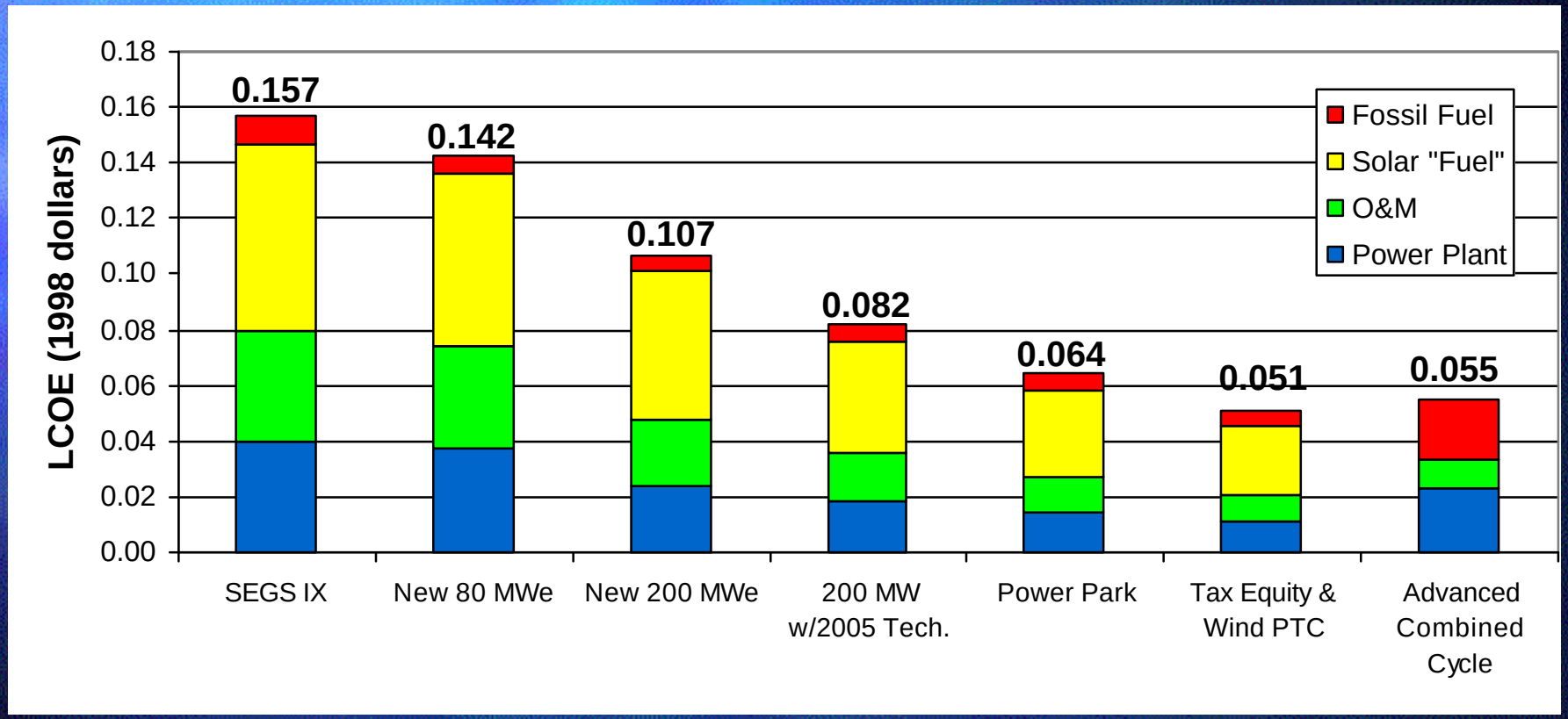
Technology Development

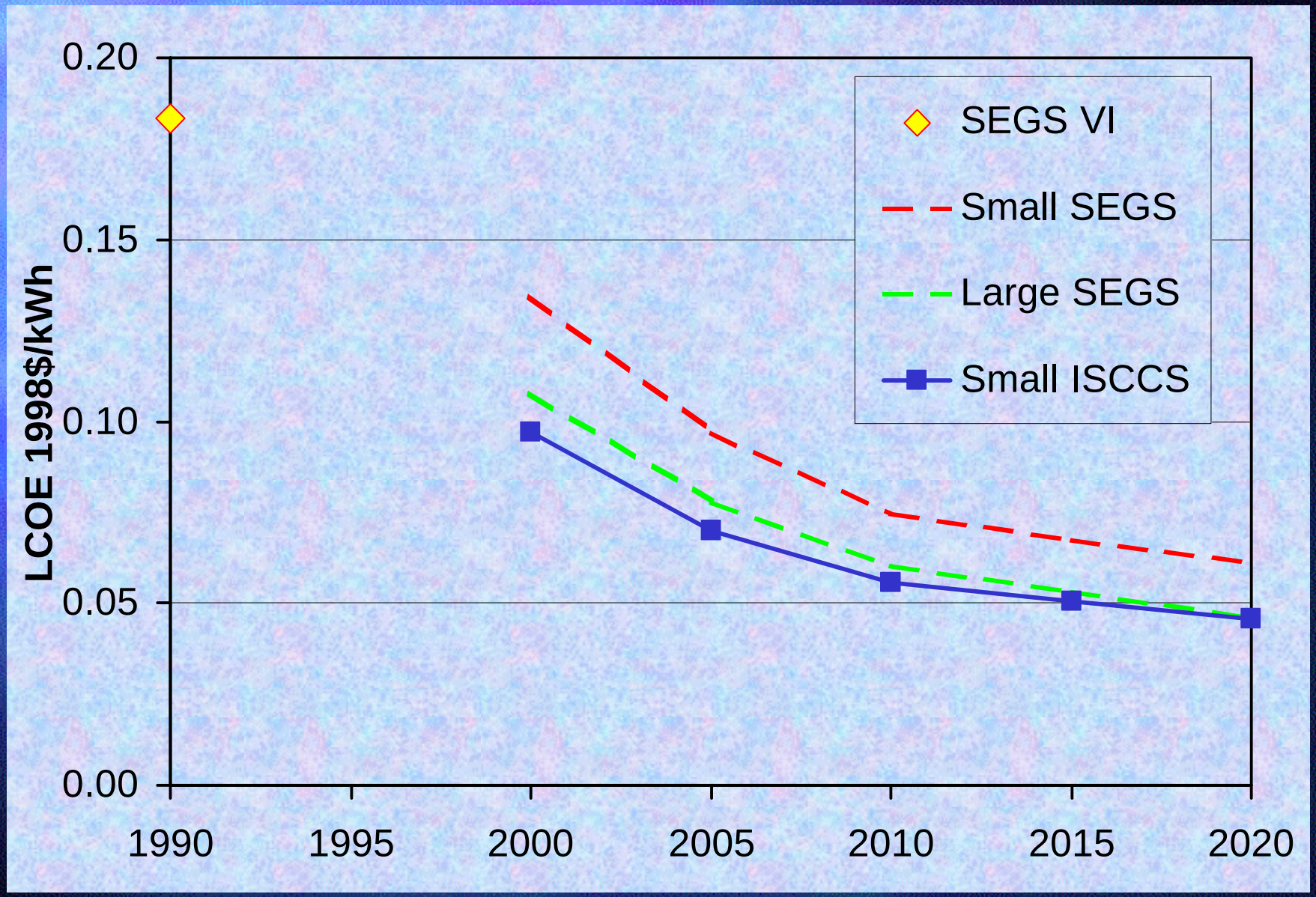
- Improved HCE Performance, Reliability, & Maintainability
- ISCCS Integration Issues
- Thermal Storage
- Reduction in Trough Structure Cost
- Direct Steam Generation in Solar Field
- O&M Tools and Training
- Standardized Designs

Cost & Performance Goals

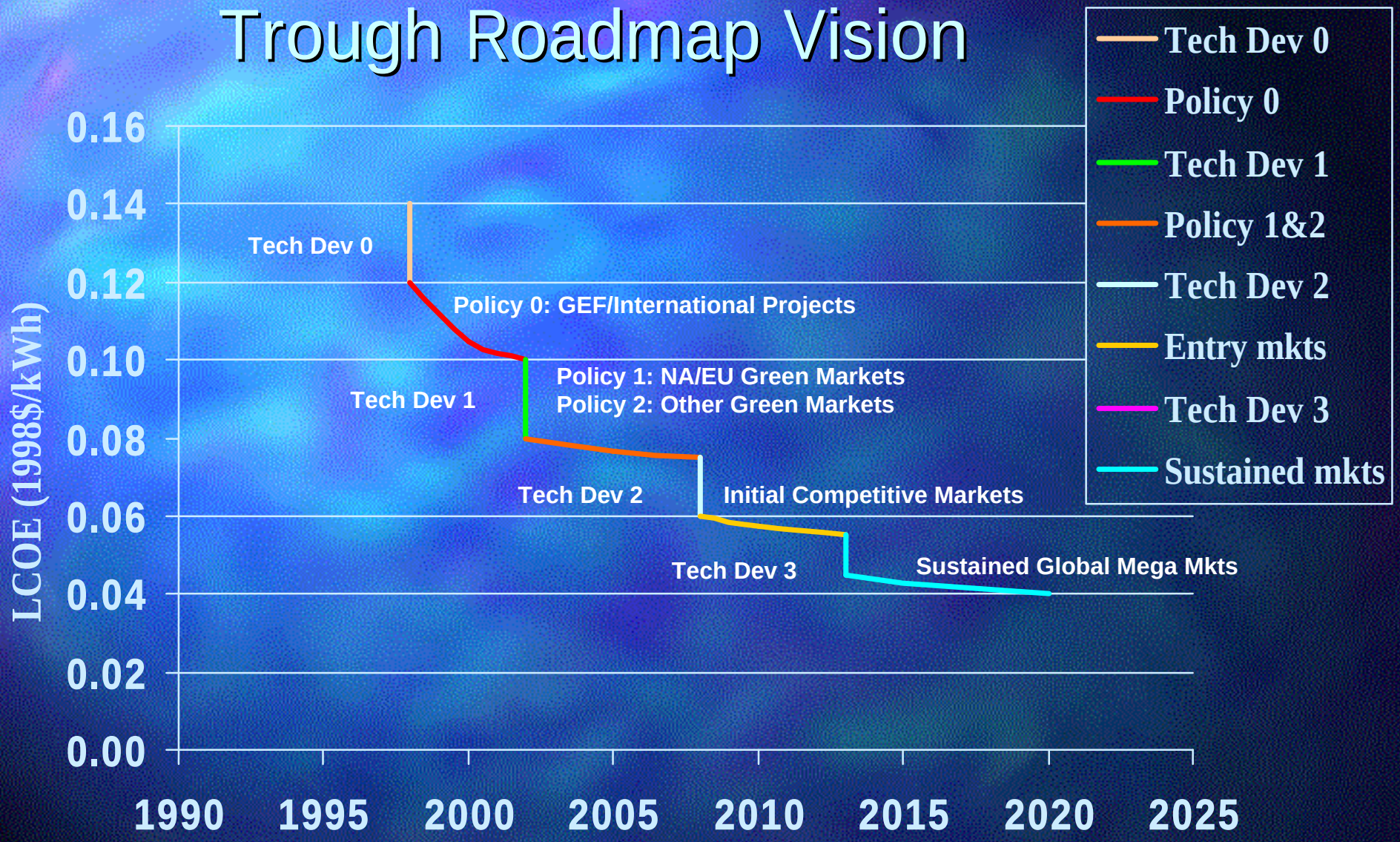
	2000	2005	2010	2015	2020
Capital Cost					
Power Block Cost	100%	75%	50%	45%	40%
Solar Field Cost	100%	75%	60%	55%	50%
Engr/Proj Mgmt.	10%	8%	8%	8%	8%
Contingency	15%	10%	10%	10%	10%
O&M Cost	100%	75%	60%	55%	50%
Annual Solar Effic.	13%	14%	15%	16%	17%

Trough Case Study Results




0.20
0.15
0.10
0.05
0.00
LCOE 1998$/kWh
1990
1995
2000
2005
2010
2015
2020
SEGS VI
Small SEGS
Large SEGS
Small ISCCS

Trough Roadmap Vision



Key Trough Roadmap Conclusions

- Significant cost reductions and performance improvements are possible
- National and international activity increasing substantially to reactivate aggressive growth
- Markets:
  - Near-term: High value/cost markets and opportunities
  - Long-term: Competitive with conventional generation
  - Path between the two has multi-faceted series of steps