Cold Fusion Public Policy: Rational – and Urgent – Need for Change

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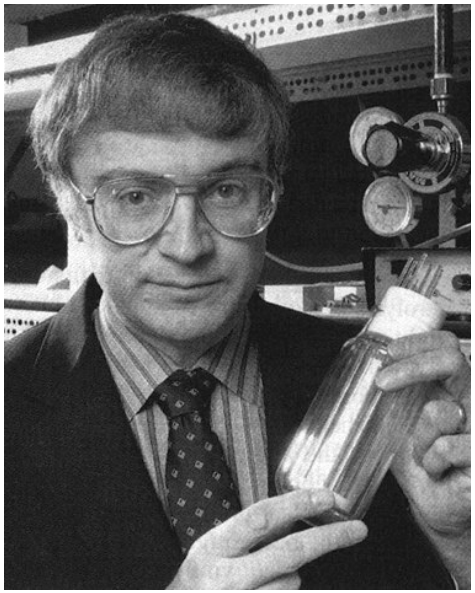
Cold Fusion Energy Source

Recognized from the Beginning

"I would think that it would be reasonable within a short number of years to build a fully operational device that could produce power or drive a steam turbine, for instance."



Stanley Pons, March 23, 1989

Similar comments were made by Martin Fleischmann

http://en.wikipedia.org/wiki/File:Stanley_Pons_cold_fusion_gear.jpg

Cold Fusion Energy Policy
Two Main Questions

- How do we get it?
- How do we deal with it when it gets here?
- That is…
  - Public support for R&D
  - Dealing with secondary impacts

http://www.angelamaiers.com/2011/01/pondering-makes-for-a-perfect-new-year.html

Energy Policy Should Be Rational!

- Maximize public benefit
- Minimize adverse collateral (secondary) effects
- Develop policies based on **evidence**
- Make corrections with policy experience
- Apply in particular to energy policy

Rational Policy for High-Impact Emerging Energy Technologies
Based on Level of Evidence

LoE	Development Support	Impact Mitigation
PoE	Equal support with other emerging technologies	Develop detailed mitigation plan (effects, parties, etc.)
CCE	Priority support over competing solutions	Prepare parties-at-interest and mitigating agencies
BRD	Crash program	Mobilize for immediate implementation

LoE – Level of Evidence
PoE – Preponderance of Evidence (>50%)
CCE – Clear and Convincing Evidence (>70%)
BRD – Beyond a Reasonable Doubt (>90%)

The Case for Increased Policy Urgency

- Recent favorable developments ("changing landscape")
- Radical changes in level of evidence?
- National security implications (geopolitical concerns)
  - Advantages to nation with initial commercial success
  - Energy-related worldwide balance of power
- Many potential advances: SKINR, Rossi, Claytor, Celani, commercial(izing) devices

Recent Cold Fusion Potential Advances
Selected Examples

- Univ. of Missouri SKINR
- Rossi's E-Cat, Hot Cat
  - Demonstrations, 2011
  - Levi et al, 2013
  - Industrial Heat, 2014
- Claytor Gas Discharge
- Celani Constantan Wires
- JET Energy "Nanor"
- Defkalion "Hyperion"
- Brillouin "CECR"
- Blacklight Power "SF-CIHT" (maybe)
- Other Researchers (this colloquium)

What do these developments mean <u>in aggregate</u>?

Cold Fusion Public Policy

Back to the Two Main Questions

- Public Support for Research and Development

- Intervention to Deal with Secondary Impacts

Evidence-Based Policy

Public Support for Development

- R&D support for the public benefit
- Evaluate in context of other emerging energy technologies
- Level of support based on level of evidence
- Full consideration of risks involved
- Many venues and types of support available

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Public Support for R&D
Ample Precedent

- Manhattan Project
- Aviation
- Microelectronics & computers
- Internet
- Nuclear power
- Biotechnology
- Space exploration
- Agriculture
- Renewable energy
- Innumerable others

Cold Fusion Levels of Evidence
Public Policy Responses for R&D

Event	LoE	Policy Response
Initial announcement and immediate investigations	PoE	Equal support with other emerging technologies
25 years of accumulated evidence (since 1989)	CCE	Priority support
Recent developments	BRD?	Crash program?

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Evidence-Based Policy

Dealing with Secondary Impacts

- Rational policy choices for the public benefit
- Direct – energy industry
  - Current energy supply infrastructure
  - All phases – production, transport, storage, use
  - Disruptive technology
- Indirect – workforce, communities, tax revenues, income redistribution, others
- U.S. and international (geopolitical concerns)
- **Solutions do exist!**

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Impact Mitigation
Ample Precedent

- Intervention for the public benefit
- Great Depression alphabet agencies (WPA, PWA, CCC, FWA, FCA, others)
- American Recovery and Investment Act (ARRA), 2009
- Auto Industry Bailout (2008-2009)
- Many others

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Cold Fusion Levels of Evidence

Policy Responses for Secondary Impacts

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Solutions Do Exist for Secondary Impacts

Technology Assessment

- Rational response to identified impacts
- Proactive approach to mitigate effects
- Intervention for “market failure”
- Well-developed methods and previous track record (OTA)
- Professional analysis with stakeholder participation
- Systematic, staged approach

Typical TA Elements

- Technology description
- Delineation of parties at interest
- Direct impacts (and populations)
- Indirect impacts (and populations)
- Policymaking apparatus (legislation, research, regulation, etc.)
- Mitigation measures
- Definition of policy alternatives
- Selection and implementation

White, Blake L, 1988, The Technology Assessment Process: A Strategic Framework for Managing Technical Innovation

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A Couple of TA Examples

- Technology Assessment of Western Energy Development

- Technology Assessment of Coal Slurry Pipelines

Technology Assessment of Western Energy Development

- 8 States: MT, ND, SD, WY, UT, CO, AZ, NM
- 6 resources
  - Coal
  - Oil
  - Natural gas,
  - Oil shale
  - Uranium
  - Geothermal
- 8 major issue areas
  - Water availability
  - Air quality
  - Water quality
  - Growth management & housing
  - Land use
  - Capital availability
  - Transportation
  - Energy facility siting

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Technology Assessment of Coal Slurry Pipelines

- Pipeline and unit train descriptions
- Economic impacts
- Environmental and social impacts
- Legal and regulatory analysis
- 11 major issues and findings

http://www.epa.gov/region9/tribal/success/03/water.html

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So What Has Changed?

- Many apparent cold fusion advances
- Increase in level of evidence
  - PoE → CCE
  - CCE → BRD??
- Potential for highly disruptive impacts
- Dealing with secondary impacts has surpassed public support for R&D
- **Level of urgency for policy response has escalated…**

Cold Fusion as a Disruptive Technology
A Bit of Elaboration

- "A technological innovation that overturns and replaces existing technologies or products in the market"
- Clayton Christiansen, 1997, "The Inventor's Dilemma"

- Potential impact on full cycle of energy production, transport, consumption
- May be deployed in a dispersed for centralized configuration (household to mega-facility)

http://www.celebritytalent.net/sampletalent/290/clayton-christensen/

Disruptive Technology
Geopolitical Implications, Example 1

- UK Ministry of Defence, 2014

  New Energy Source. A novel, efficient form of energy generation could be developed that rapidly lowers demand for hydrocarbons. For example, the development of commercially available cold fusion reactors could result in the rapid economic marginalisation of oil-rich states. This loss of status and income in undiversified economies could lead to state-failure and provide opportunities for extremist groups to rise in influence.

- *Thanks go to Dave Nagel for posting this…*

Disruptive Technology
Geopolitical Implications, Example 2

- US Defense Intelligence Agency, 2009

  Technology Forecast: Worldwide Research on Low-Energy Nuclear Reactions Increasing and Gaining Acceptance.

  DIA assesses with high confidence that if LENR can produce nuclear energy at room temperatures, this disruptive technology could revolutionize energy production and storage, since nuclear reactions release millions of times more energy per unit mass than do any known chemical fuel.

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Are Proactive Policies Really Needed?

- Let market forces work – laissez faire?
- Minimize traditional government roles?
  - Support for technological advances
  - Response to market failures
- Is intervention really a good idea?
- Are the answers to key questions clear (or just a matter of opinion)?

Barriers to Rational Cold Fusion Policy

- Rational vs ideological policy issues
  - Dealing with what exists vs “what should be”?
  - Diversity of opinion on role of government intervention
  - Political overtones – US policy issue “across the board”?
- Sociology of science issues…

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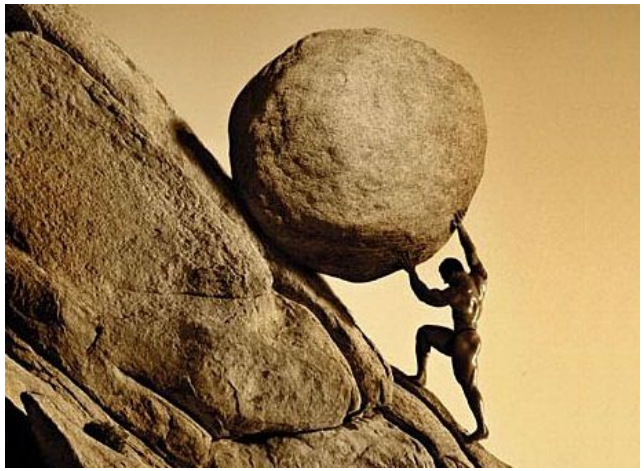
Sociology of Science Issues

- Thomas Merton – "father" of sociology of science: CUDOS
  - Communalism -- Originality
  - Universalism -- Skepticism
  - Disinterestedness
- Decline of influence of science on public policy
- Process of initial cold fusion rejection
- Continued "Pathological disbelief" (Brian Josephson)
- "Science advances one funeral at a time" (Max Planck)

Where Do We Go for Policy Change?

- Is proactive intervention still feasible?
- Where can intervention occur?
  - International (EU, e.g.)?
  - National (Executive, Congress)?
  - Agencies?
- Policy change will be different…
  - Development support
  - Impact mitigation



http://www.borgenmagazine.com/public-welfare-foundation/

This slide is being updated…

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Summary

- Cold fusion has tremendous potential public benefit
- CF policy must address both realization and mitigation of impacts
- Rational energy policy is the best approach
- Policy urgency increases as CF realization nears
- CF promises to be a highly disruptive energy source
- Significant barriers remain for rational CF policy
- How policy change will realized is uncertain
- The CF path forward remains cloudy

http://www.oilersaddict.com/edmonton-oilers-question-marks/