

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

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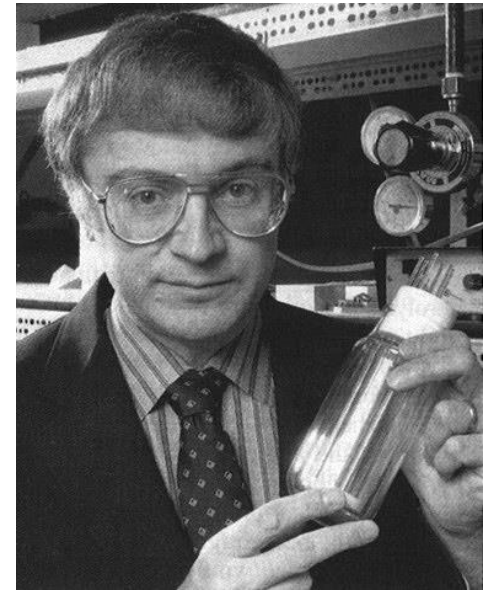


# Cold Fusion Energy Source

## *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*

# 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



# 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*

<u>LoE</u>	<u>Development Support</u>	<u>Impact Mitigation</u>
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 in aggregate?*

# 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
- Many venues and types of support available
- Full consideration of risks involved

# Public Support for R&D

## *Ample Precedent*

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



# LENR Levels of Evidence

## *Public Policy Responses for R&D*

<u>Event</u>	<u>LoE</u>	<u>Policy Response</u>
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!**

# 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

# LENR 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

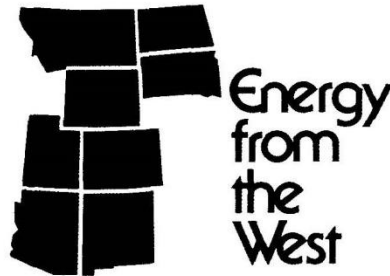
- Technology description
- Delineation of parties at interest
- Direct impacts (and populations)
- Indirect impacts (and populations)
- Policymaking apparatus (legislation, research, regulation, etc.)
- Mitigation measures
- Definition of policy alternatives
- Selection and implementation





# A Couple of TA Examples

- Technology Assessment of Western Energy Development



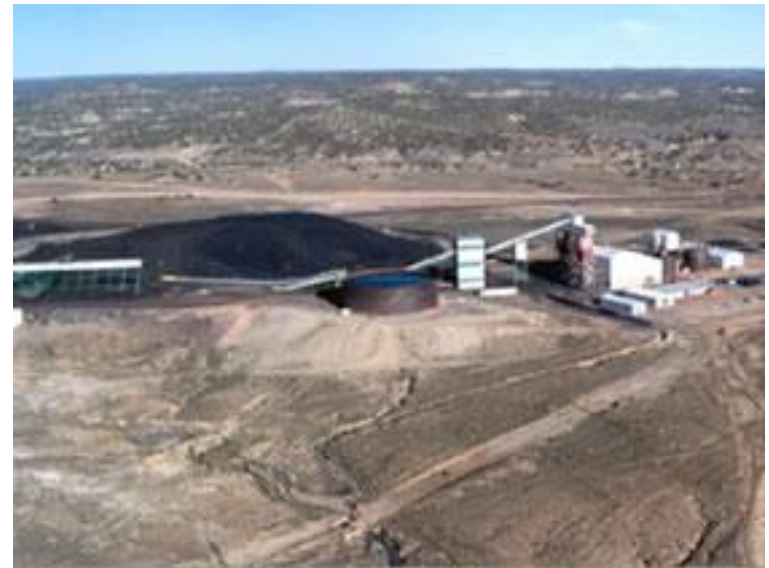
- Technology Assessment of Coal Slurry Pipelines

# 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

# 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



# So What Has Changed?

- Many apparent LENR 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...**

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



# 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.

# 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

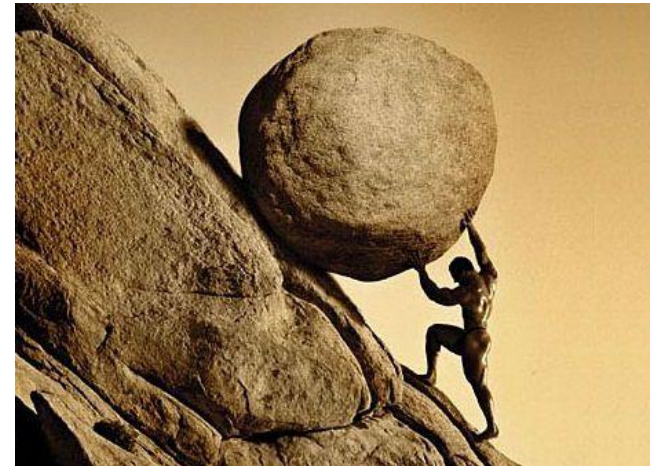
- Rational vs ideological policy issues
  - Dealing with what exists vs “what should be”?
  - Diversity of opinion on role of government intervention
  - Political overtones – US policy issue “across the board”?
- Sociology of science issues...

# Sociology of Science Issues

- Thomas Merton – “father” of sociology of science:  
CUDOS
  - Communalism
  - Universalism
  - Disinterestedness
  - Originality
  - Skepticism
- Decline of influence of science on public policy
- Process of initial LENR 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 feasible?
- Where can intervention occur?
  - International (EU, e.g.)?
  - National (Executive, Congress)?
  - Agencies?
- Policy change will be different...
  - Development support
  - Impact mitigation



# 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 should be made based on the level of evidence
- CF promises to be a highly disruptive energy source
- TA represents a rational response to secondary impacts
- Urgency of policy change increases as CF realization nears
- Significant barriers remain for rational CF policy
- How policy change will occur is uncertain
- The CF path forward remains cloudy

