Real world barriers to Energy Efficiency

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Theories of Tech Diffusion

- Technology diffusion
  - Early adopters and diffusion curves
- Economists
  - Micro-economic models of utility maximisation
- Social science
  - Social networks and me-too diffusion modes
- Psychology
  - Attitudes and perceptions

The Trouble with Theory

"Each social science discipline offers competing and often conflicting models of human behaviour. Differences persist because disciplinary models are founded on selective assumptions commensurate with established theories and particular types of empirical data."

C. Wilson, 2008

The Experiment

- Why is there such a gap between what academics think are winning technologies and what the market actually adopts?
- So, lets promote those which should be like rolling logs downhill. Focus on technologies that:
  - have simple pay-back periods of 5 years or less
  - reduce **energy/GHGs** by at least 50%
  - have a proven track record
- Use the concern about climate change, energy price uncertainty to fund projects.

List of Technologies

- Hot-in-place paving
- Distributed co-gen
- Dehumidifiers for public pools
- Ground-source heat-pumps
- Cloud computing in institutions ...

A Heuristic for Story Telling

Key Factors		Client	
		Public	Private
Investor	Public		
	Private		

Hot In-Place Repaving

Hot In-Place Repaving

Road Maintenance Contracts		Client	
		Public	Private
Investor	Public	√	
	Private	√	

- Road performance is better than conventional
- Recycles 100% of road material in-situ, ...
- Costs only 40% of conventional.
- Concern about bitumen cost has led to cost+ material contracts.
- Differentiated market: HIP= $12/m2 : M&F = $20/m2
  - except in N. Carolina!

Dehumidifiers In Public Pools

Dehumidifiers In Public Pools

Accounting Behaviour		Client	
		Public	Private
Investor	Public	√	
	Private	√	

- Reduces pool energy consumption by 50+%.
- Municipal accounts differentiate capital and operating costs. An operational advantage cannot be linked to a capital decision.
- Private investors have learned hard lessons from tinkering hands.

Ground-Source Heat-Pumps

Stds/Structures		Client	
		Public	Private
Investor	Public	√	
	Private		√

- Reduces energy for space conditioning by ≥70%.
- Gouging by vendors wipes out economics
- Best deployed at the scale of neighbourhoods and supported using zoning to co-locate demands for heat and cold
- Lack of standards has led to many bad systems.

Ground-Source Heat-Pumps

Stds/Structures Regime Change		Client	
		Public	Private
Investor	Public	√	√
	Private		√

- Reduces energy for space conditioning by ≥70%.
- Gouging by vendors wipes out economics
- Best deployed at the scale of neighbourhoods and supported using zoning to co-locate demands for heat and cold
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Electric Cars

Electric Cars

GHG Mania		Client	
		Public	Private
Investor	Public	√	
	Private		√

- Superficially free from fossil energy inputs
- Battery technology
- Marginal electricity costs
- Tax on transport fuels
- $20,000 to $80,000 conversion cost.
- GHG reductions highly depend on source of electricity.

Distributed Co-gen/ORC

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Distributed Co-gen/ORC

Buy-back Contracts & Connection Stds		Client	
		Public	Private
Investor	Public		
	Private	√	√

- Can deliver ≥80% of primary energy as energy services.
- Delivers higher reliability power at lower cost where system expansion is needed.
- Co-gen Investors want long term contracts for fuel and heat and energy sales assuring them adequate returns.
- Opposed by traditionalist engineers in power utilities.
- Hindered by antiquated PUC regulations.

Experience

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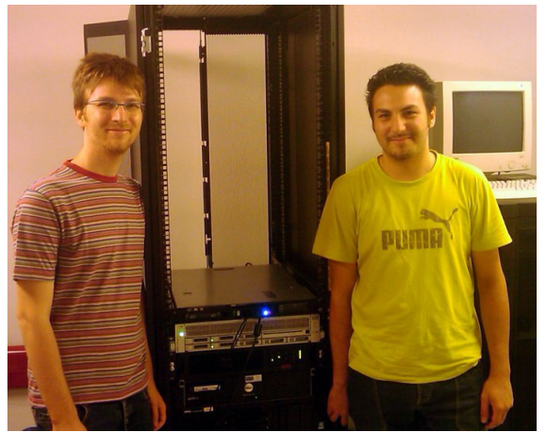

Experience

- **Social, political and economic context**
  - Technology diffusion
    - Early adopters and diffusion curves
  - Economists
    - Micro-economic models of utility maximization
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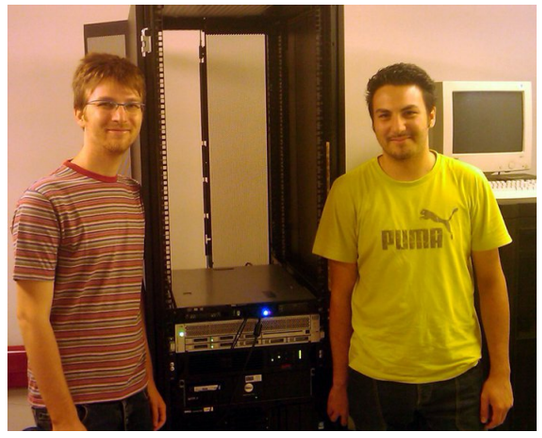

- **Inertia, willful ignorance and divergent risk tolerance**

Summary

- Public sector:
  - high operating costs easier to tolerate than new capital investments.
  - less entrepreneurial / less familiar with technology.
  - often have structural barriers to change
  - crises, not intrinsic benefits, appear to trigger change.
- Private sector:
  - principal agent issues abound.
  - entrepreneurs often shoot the golden goose.
  - are unprepared for the onslaught.
  - at times of crisis, other opportunities have much higher payoff.