

Water as Energy

Or drinking a kilowatt smoothie

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Agenda

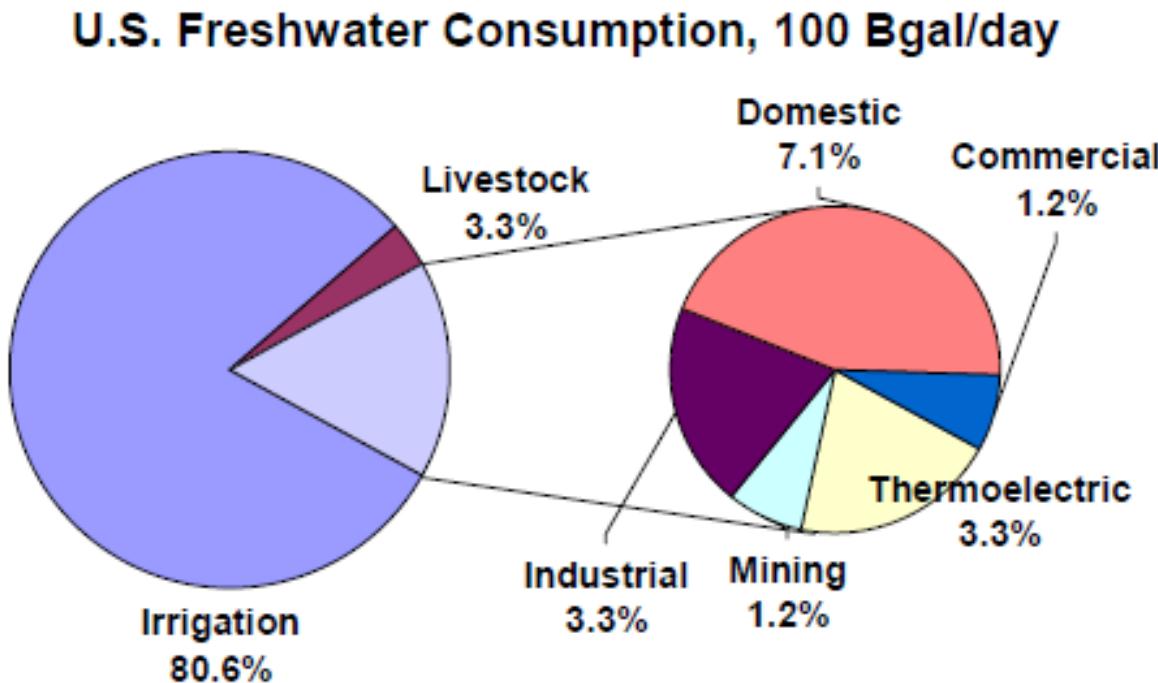
AM

- Water as Energy
- Jeff Clarke, General Manager, Alderwood Water District

PM

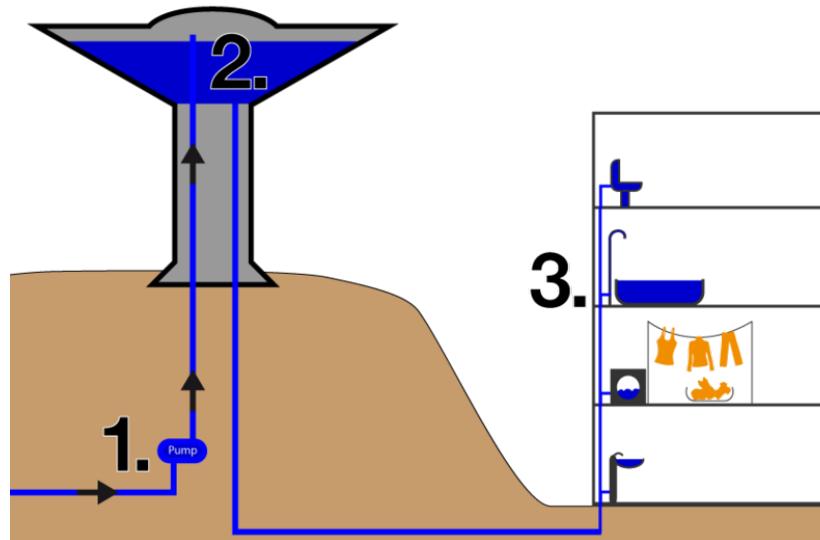
- Presentations
 - Bluebird Cove
 - LS102
- General Q&A once done

What is Water?



**Figure II-4. Estimated Freshwater Consumption by Sector, 1995
(Solley et al., 1998)**

What is the intersection of energy and water?

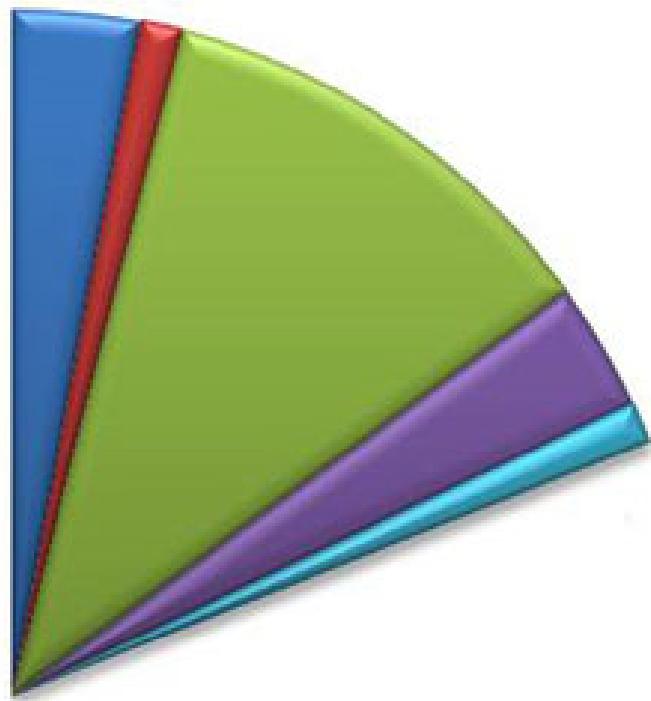


The lack of water is obvious



Water: The single largest consumer of energy

- In California, 20 % of all energy is consumed by pumping water.



- Agricultural End-Use: 3%
- Agricultural Water Supply and Treatment: 1%
- Residential, Commercial and Industrial Water End-Use: 11%
- Residential, Commercial and Industrial Water Supply and Treatment: 3%
- Wastewater Treatment: 1%

Is water a commodity or a luxury?

What are different ‘variations’ of water?

...of drinking water?

Options for Beverages

	Gal per Capita per year	Gallons consumed per year (Billion)
Soda	44.7	14.25
Bottled Water	28.3	9.02
Beer	20.8	6.63
Milk	20.4	6.51
Coffee	18.5	5.90
Fruit Beverage	11.5	3.67
Tea	10.3	3.28
Sports Drinks	4	1.28
Wine	2.3	0.73
Value-Added Water	1.5	0.48
Distilled Spirits	1.5	0.48
Energy Drink	1.2	0.38

A wide range of prices

	Gal per Capita per year	Retail Price*	Gallons consumed per year (Billion)
Soda	44.7	\$ 12.74	14.25
Bottled Water	28.3	\$ 6.78	9.02
Beer	20.8	\$ 12.48	6.63
Milk	20.4	\$ 3.29	6.51
Coffee	18.5	\$ 18.80	5.90
Fruit Beverage	11.5	\$ 5.41	3.67
Tea	10.3	\$ 20.40	3.28
Sports Drinks	4	\$ 6.76	1.28
Wine	2.3	\$ 65.61	0.73
Value-Added Water	1.5	\$ 11.28	0.48
Distilled Spirits	1.5	\$ 110.38	0.48
Energy Drink	1.2	\$ 19.12	0.38

Options

	Gal per Capita per year	Retail Price*	Gallons consumed per year (Billion)
Tap Water (Drinking)	32,850	\$ 0.0016	146,000.00
Soda	44.7	\$ 12.74	14.25
Bottled Water	28.3	\$ 6.78	9.02
Beer	20.8	\$ 12.48	6.63
Milk	20.4	\$ 3.29	6.51
Coffee	18.5	\$ 18.80	5.90
Fruit Beverage	11.5	\$ 5.41	3.67
Tea	10.3	\$ 20.40	3.28
Sports Drinks	4	\$ 6.76	1.28
Wine	2.3	\$ 65.61	0.73
Value-Added Water	1.5	\$ 11.28	0.48
Distilled Spirits	1.5	\$ 110.38	0.48
Energy Drink	1.2	\$ 19.12	0.38
Tap Water Total	32,850	\$ 0.0016	146,000.00

Should all water be regulated?

the guardian

home > US

world opinion sports soccer tech arts lifestyle fashion bu ≡ all

California drought

California drought spurs protest over 'unconscionable' bottled water business

- Report finds lax oversight, with some operations unlicensed for years
- Petition against Nestlé bottling operations garners 150,000 signatures

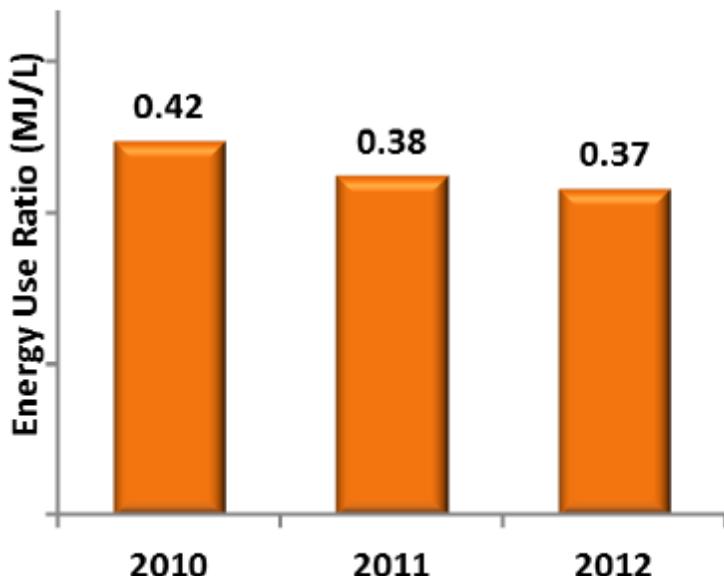


Where is the *boundary*?

Should water be based on choice?

Figure 5: Carbonated Soft Drink Energy Use Ratio Performance

N=676
Range (2012) – 0.20 – 0.98 MJ/L
Improvement = 12%



Beverage Industry Continues to Drive Improvement in Water and Energy Use. Beverage Industry Environmental Roundtable. 2013 Trends and Observations

Table 1-2: Range of Energy Intensities for Water Use Cycle Segments

Water-Use Cycle Segments	Range of Energy Intensity kWh/MG	
	Low	High
Water Supply and Conveyance	0	14,000
Water Treatment	100	16,000
Water Distribution	700	1,200
Wastewater Collection and Treatment	1,100	4,600
Wastewater Discharge	0	400
Recycled Water Treatment and Distribution	400	1,200

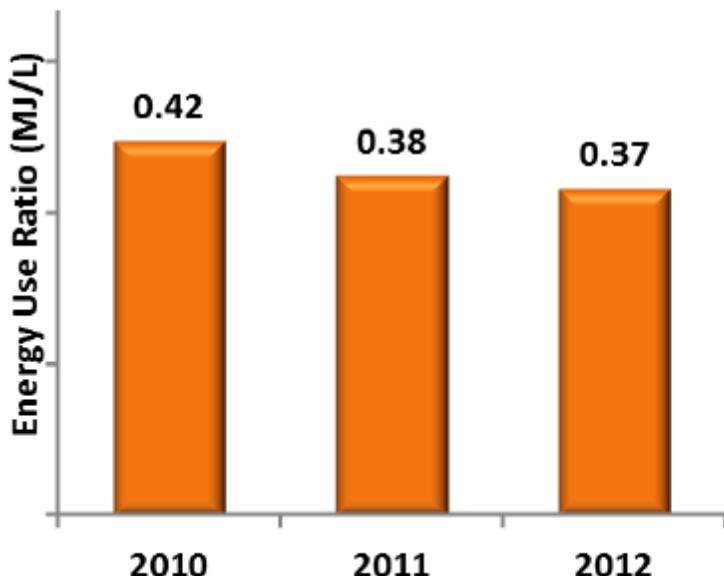
California's Water-Energy Relationship. California Energy Commission Final Staff Report 04-IEPR-01E

Should water be based on choice?

380 Wh / Gal

Figure 5: Carbonated Soft Drink Energy Use Ratio Performance

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5 Wh / Gal

Table 1-2: Range of Energy Intensities for Water Use Cycle Segments

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Water Rights Model

- Managed by states
- Riparian Rights (governed by land possession)
mostly on the east coast
- Prior Appropriation Rights (governed by end-use
and first-time-in-use) mostly on the west coast

Prior Appropriation Theory

- The first person to take a quantity of water from a source for “beneficial use” – agriculture, industrial or household – has the right to continue to use that quantity of water in perpetuity.
- Subsequent users take the remaining water for their own beneficial use, provided it doesn’t impinge on the rights of the previous user
- *Water rights is separate from land rights*

History

- Gold Mines – Prior Appropriation applied to the minerals in a mine.
- They needed water! So applied the principal to water diversion too.



CA Aqueduct

- To “correct an accident of people and geography” – Governor Pat Brown
- 70% of water in Northern CA
- 80% of demand in Southern CA
- What encouraged the discrepancy?



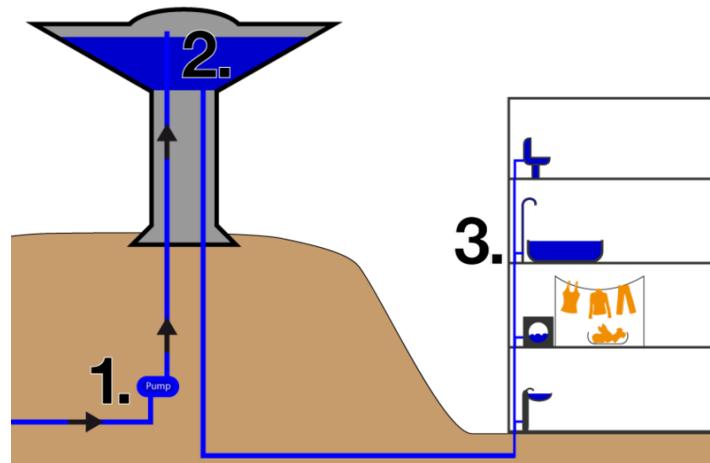
A utility model approach

- A gallon is a gallon is a gallon. Water is a public commodity that every should have access to.
- What is the lowest cost to provide for it?
- Is this the right approach?

A transportation model approach

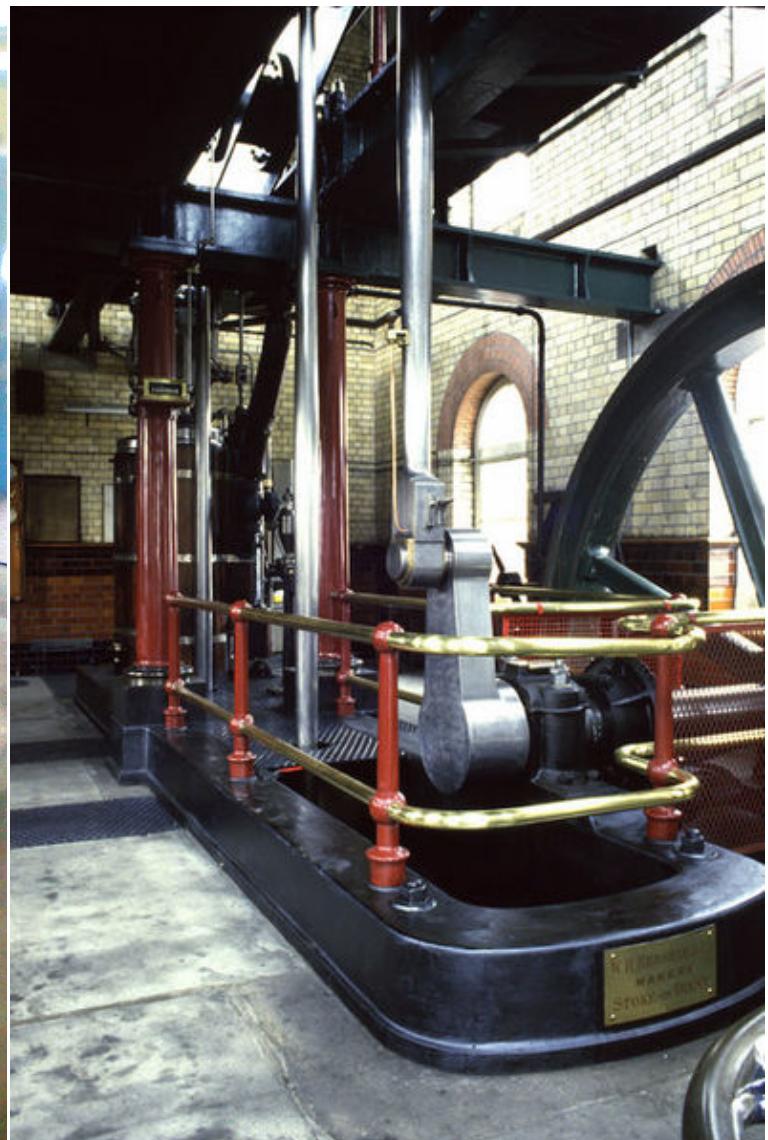
- Government pays for the basic pipes.
- You buy whatever water you can afford.
- Is this the right approach?

What is the intersection of energy and water?



- In California, 2-3 % of all energy is consumed by pumping water.
- It is the single largest consumer of energy.

Water and Power



Water and Power

Alderwood is negotiating with SnoPUD about using more water to serve an area, but that reduces what they have available for power generation. We are also working on stations to pump water and sewage, and they are major power users.

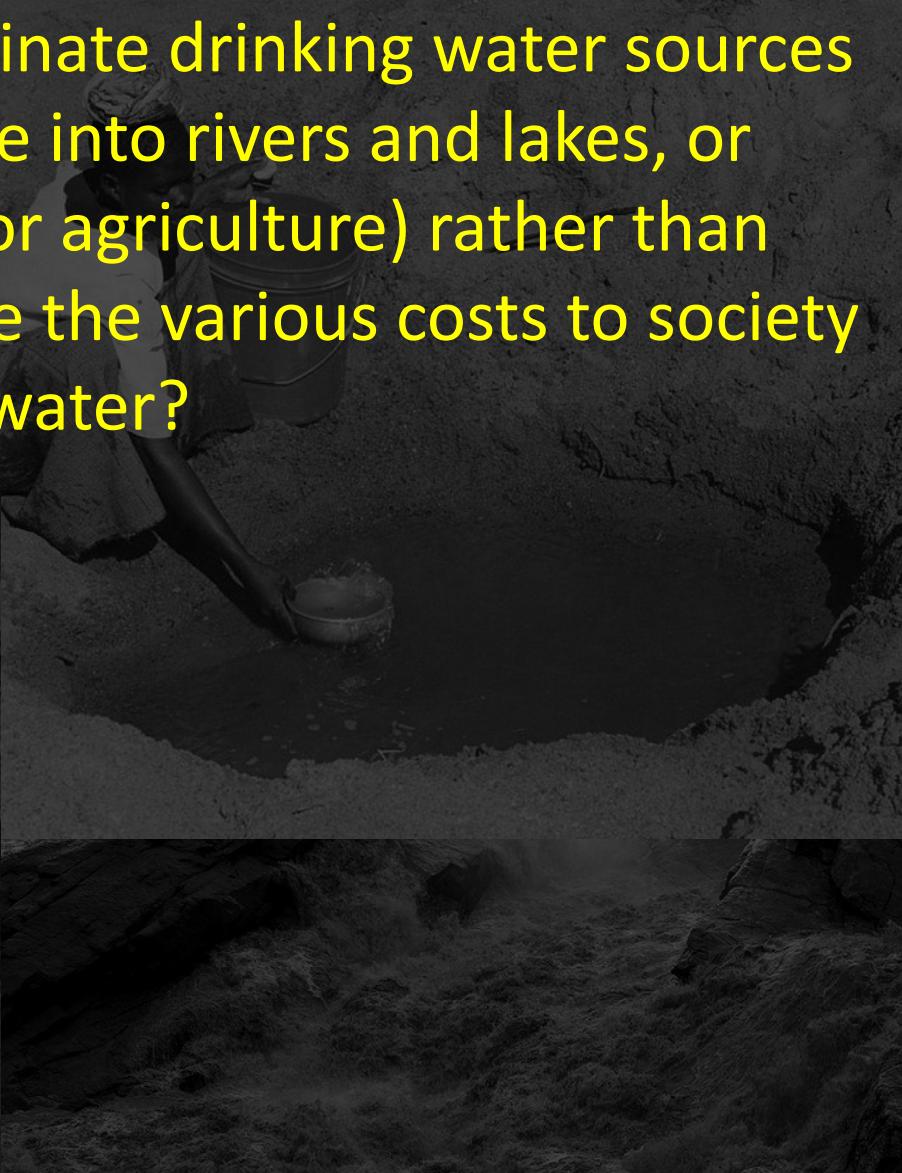
Water is plentiful in Western Washington but in short supply in the east. How should we allocate energy and water to best utilize the resource?

What are the costs of polluted water?



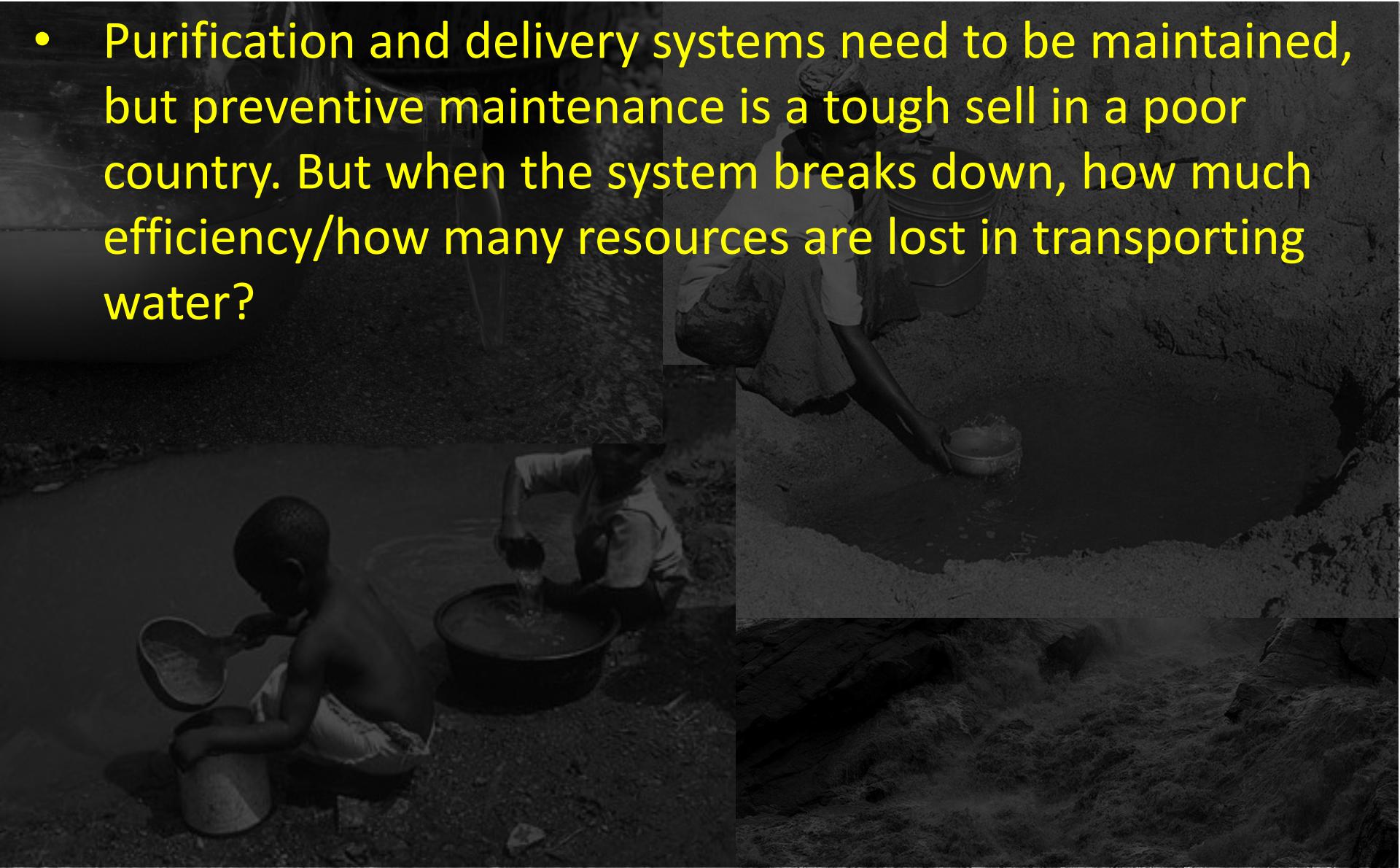
What are the costs of polluted water?

- It is cheaper to both contaminate drinking water sources (ie pouring untreated sewage into rivers and lakes, or excessive use of chemicals for agriculture) rather than treating it properly. What are the various costs to society of people drinking polluted water?

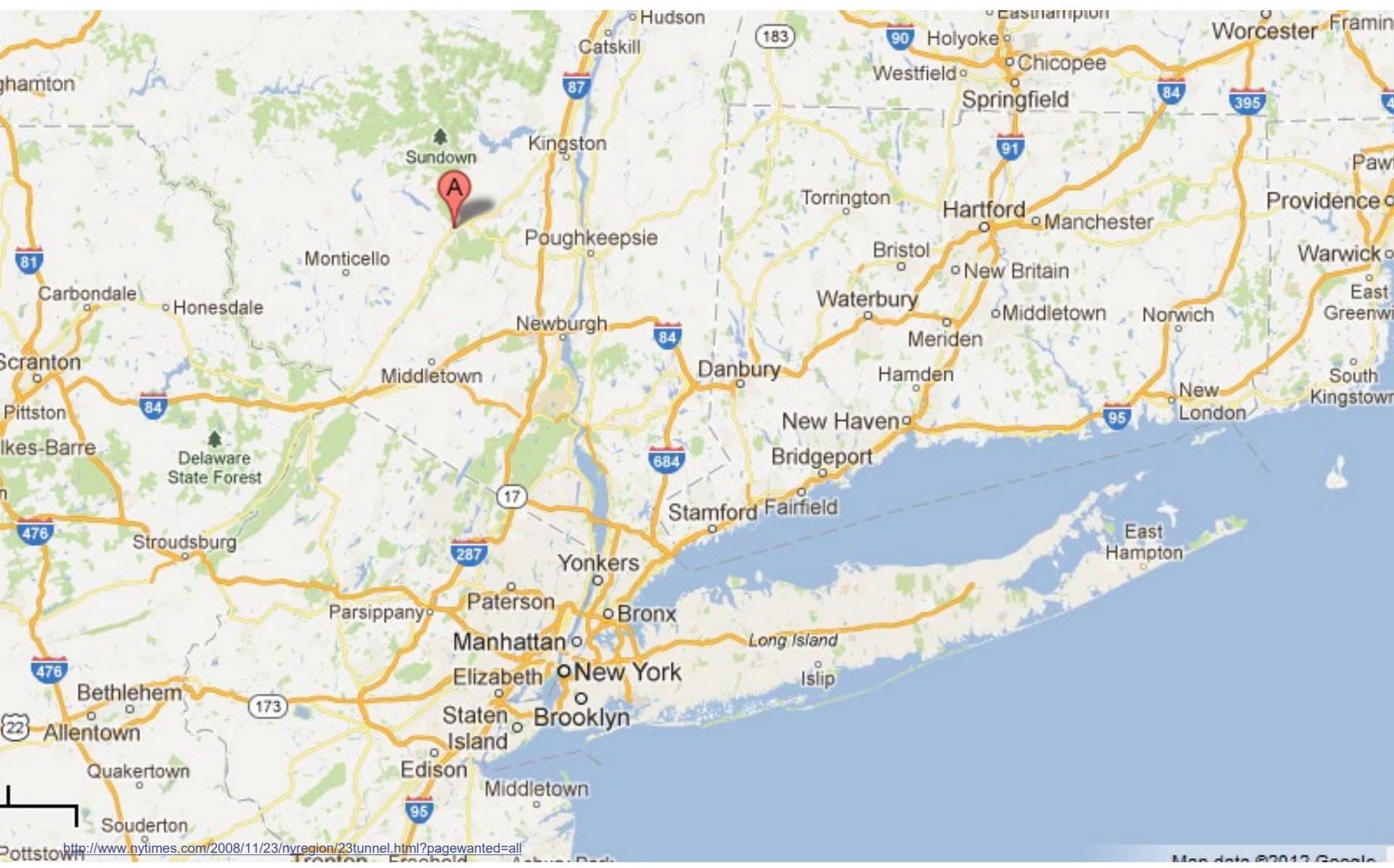


Energy Transportation

- Purification and delivery systems need to be maintained, but preventive maintenance is a tough sell in a poor country. But when the system breaks down, how much efficiency/how many resources are lost in transporting water?



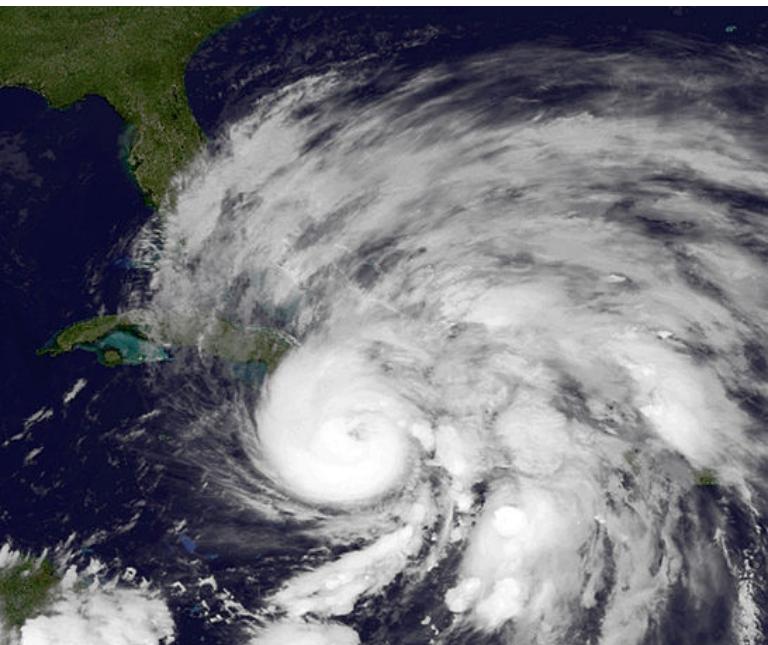
The Wawarsing Leak



The Wawarsing Leak

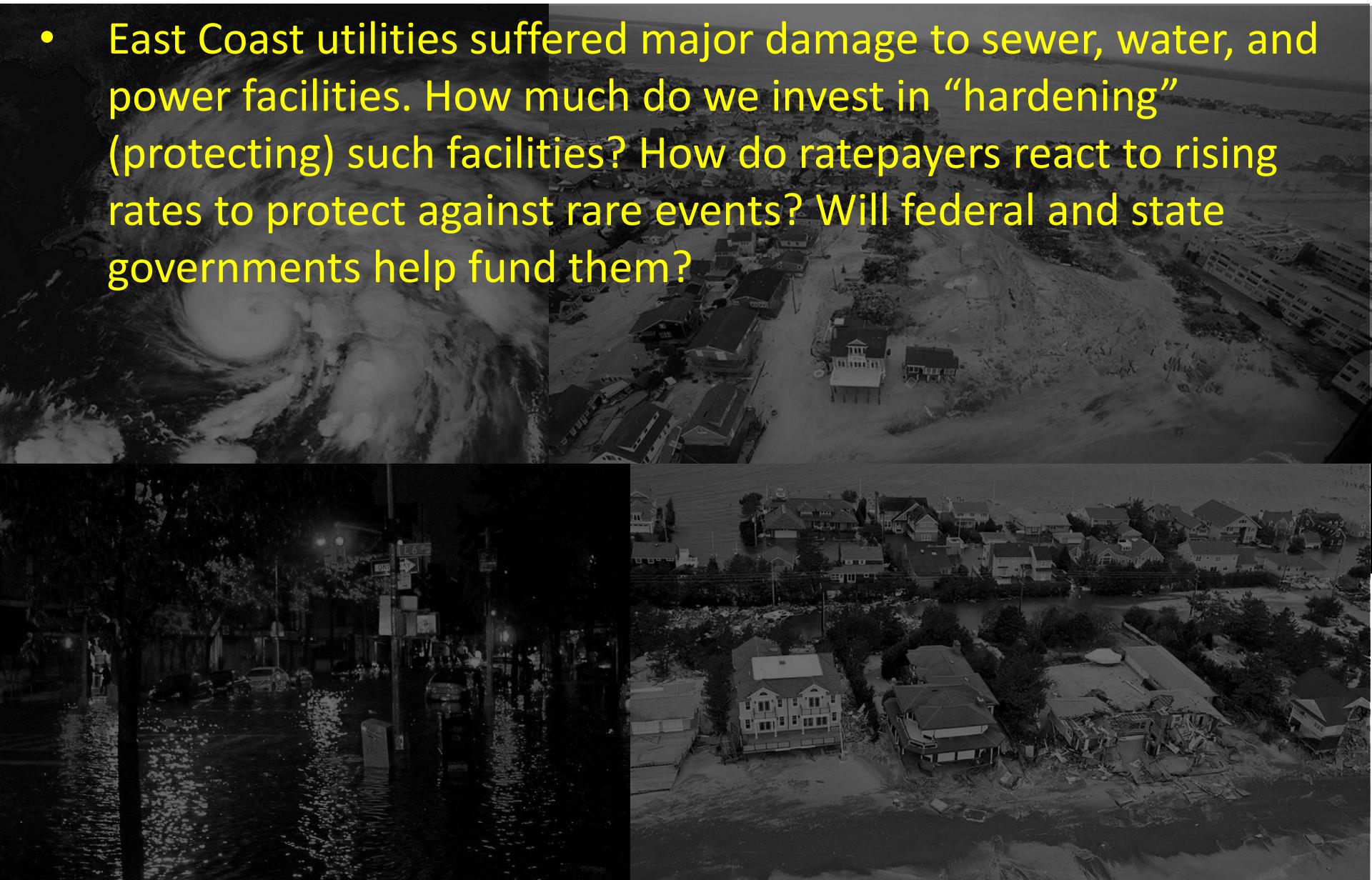
- 900 million gallons of water is piped through the Delaware Aquaduct to NYC each day. The pipes at Wawarsing leaks at 20-36 million gallons per day. This has flooded many dozen homes. This specific case is extreme, but the problem is not uncommon for water utilities. How should utilities invest to fix leaks yet keep water flowing to serve customers?

Hurricane Sandy and Resiliency



Hurricane Sandy and Resiliency

- East Coast utilities suffered major damage to sewer, water, and power facilities. How much do we invest in “hardening” (protecting) such facilities? How do ratepayers react to rising rates to protect against rare events? Will federal and state governments help fund them?

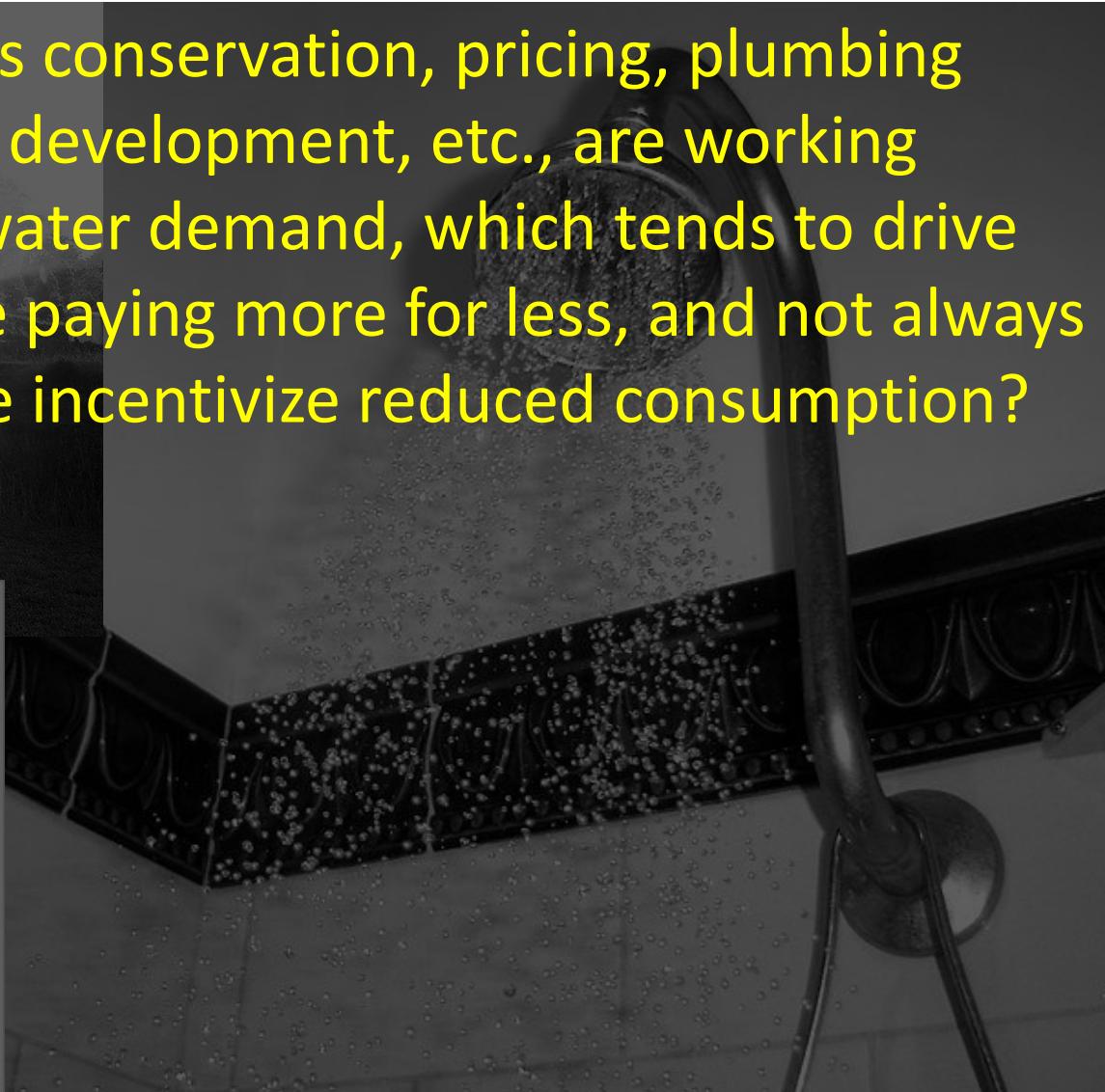


Sell less but pay more



Sell less but pay more

- Many factors, such as conservation, pricing, plumbing codes, denser urban development, etc., are working together to reduce water demand, which tends to drive up prices. People are paying more for less, and not always liking it. How can we incentivize reduced consumption?



In summary

- Cost of collecting water is high.
- Cost of pumping water is high.
- Cost of cleaning water is high.
- But the cost of not having clean water is higher.
- *Remember the bumper sticker: “If you think education is expensive, try ignorance.”*
 - *In this case, “If you think clean water is expensive, try contaminated water.”*