Business Decisions in Reality: CHP at Hexion

Lecture 11

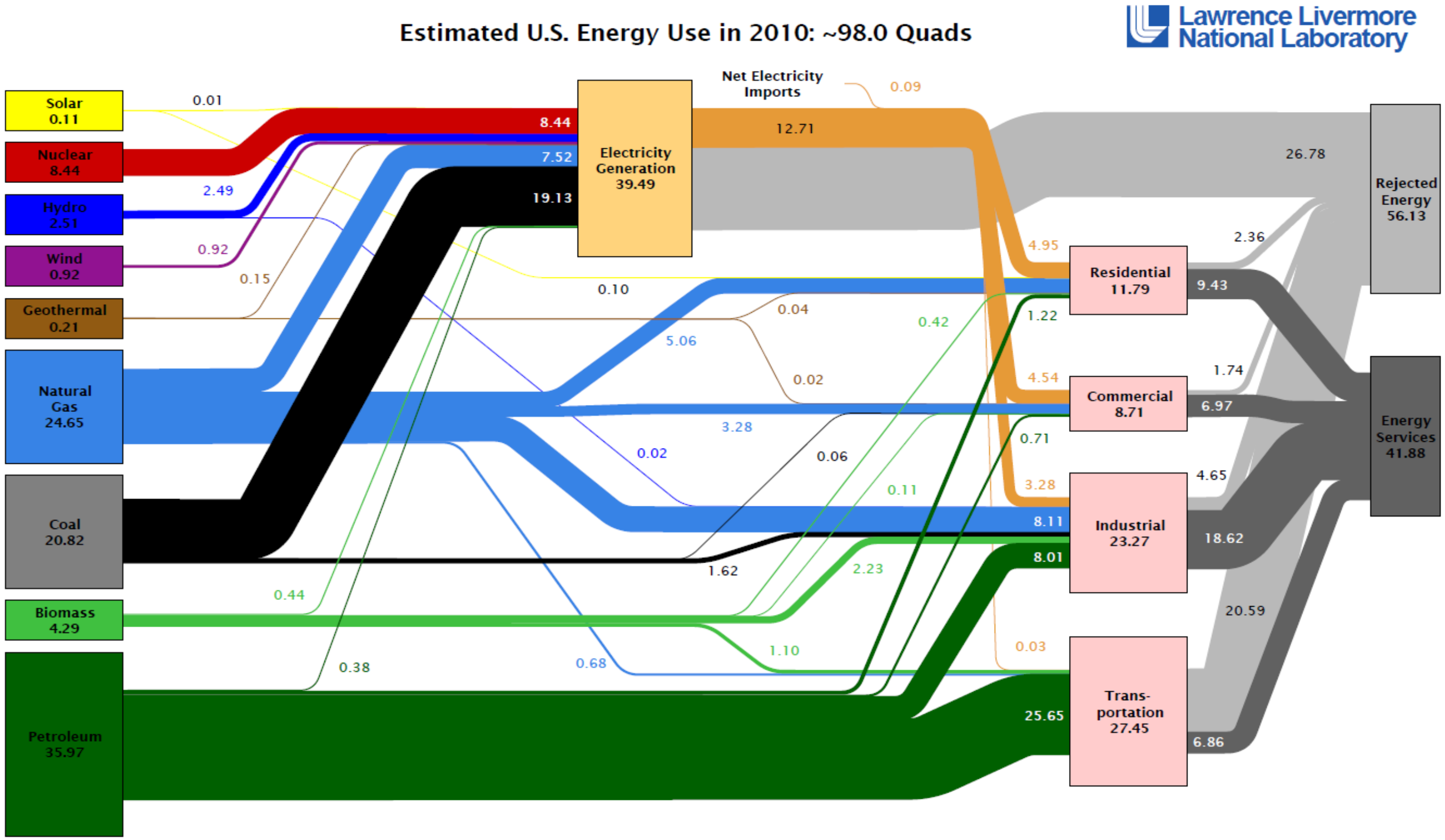
New “What is Business For?” Issue: Political Campaigns & Super PACs

- Before the Supreme Court’s 2010 *Citizens United* decision, campaign contributions by corporations & unions were barred, as was “electioneering” – “independent” ads near elections
- Now, corporations, unions, & individuals can give any amount of money to Super PACs, Political Action Committees that can run any sort of ads at any time in any amount – freedom of speech…
  - Ordinary PACs funded by limited “voluntary” individual contributions can make limited campaign contributions
- <u>Should</u> publicly-held corporations give to Super PACs?
- In fact (Sunlight Foundation), most corporations that make significant Super PAC contributions seem to be privately held
  - One exception is Consol, a coal producer, $125k for Romney; not obviously in shareholders’ interest… Captive board?
  - Lots of private corporations, individuals, law firms, unions, etc.

Hexion, 2003

- Where is this plant located, what does it do?
- What problem/opportunity is Darren considering?
- What options has he considered?
- Why has he focused on CHP?
- Would the CHP proposal have a big profit impact?

Waste/Rejected Energy in the US



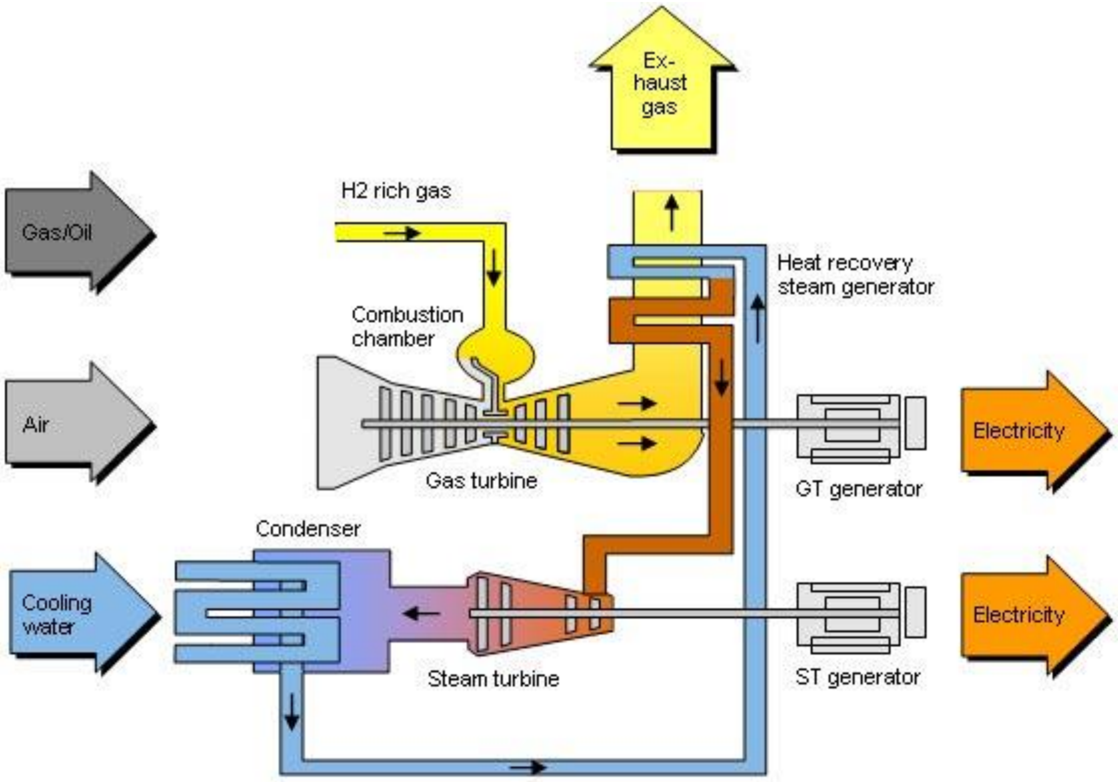
Waste (“Rejected”)/Total: Transportation 75%, Electricity 32%, Residential ≈ Commercial ≈ Industrial ≈ 20%

What form does waste energy generally take?

Two Main Forms of CHP

- District heating: use waste heat from electricity generation heat water, piped to heat nearby buildings – Denmark, Soviet Union
  - Needs powerplants in urban areas – not too popular
  - Also needs a relatively cold climate…
  - 1978 PURPA subsidies in the US didn’t do much
- Electricity generation: use waste heat to make steam to drive a turbine – needs “high quality” heat, large ΔT
  - In generation, combined cycle plants are very efficient
  - In industrial settings, capture heat from various sources

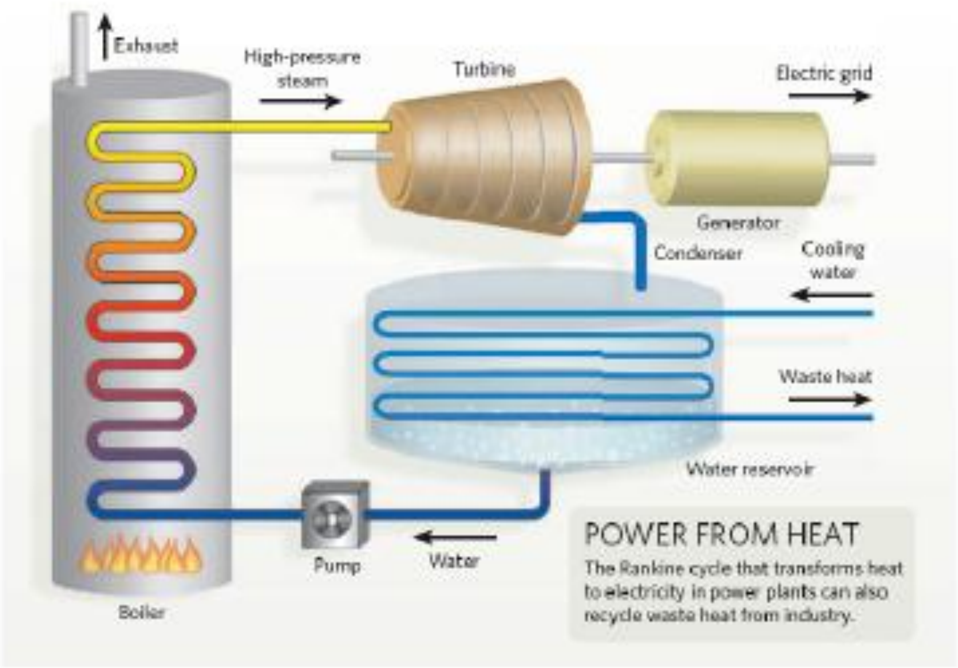
Basic CCGT Story:



Source: http://www.powergeneration.siemens.com/products-solutions-services/power-plant-soln/combined-cycle-power-plants/

The proposal before Hexion – but what was the source of heat here?

Figure 1 *Waste Heat Recovery Process Flow Being Considered at Hexion*



Source: Tom Casten, "Energy Should Always Work Twice," Nature, March 2009.

Major Benefits of CHP in General

Benefits		
Financial	**Operational**	**Environmental**
Reduce primary energy costs by up to 30%	Improve the security of electrical supply	Reduce fossil fuel usage
Reduce energy expenses by up to 20%	Reduce or eliminate utility power purchases	Increase energy efficiency
Stabilize the risks associated with rising energy prices	Improve the security of heat supply	Reduce GHG emissions
Provide potential additional revenues through sales of excess power	Provide electricity, heat, and cooling simultaneously	Prevent dispensing hot water into natural waterways

Case mentions two alternatives to NPV

- Cash flows c_t: $NPV(\vec{c}, r) \equiv \sum_{t=0}^{\infty} \frac{c_t}{(1+r)^t}$

- Payback period: Smallest T such that $\sum_{t=0}^{T} c_t > 0$
  - Suppose T = 2 but the project then dies – lousy investment!
  - Need to consider what happens AFTER T!

- Internal rate of return, IRR: (Smallest) r* such that $NPV(\vec{c}, r^*) = 0$
  - <u>IF</u> only one root (negative flows followed by positive), means that NPV > 0 for r < r*; deals with opportunity cost uncertainty
  - But ranking projects by their IRR makes little sense…

Darren’s CHP NPV Analysis

South Glens Falls, New York, USA

Turbosteam

Assumptions

Annual Electrical Savings	$89,300	
Average price of electricity in 2003 (per Kwh)	7%	
KWh saved per year	$1,275,714	
Inflation	Electricity	2%
	Maintenance	2%
	H2O Chemicals	2%
Discount Rate for Net Present Value	10%	
Depreciation Life (tax)	7 Year straight line	
Federal Tax Rate	35%	
State Marginal Tax Rate	5.50%	

Year ending:	Dec-04	Dec-04	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13	Dec-14	Dec-15	Dec-16	Dec-17	Dec-18	Dec-19
Savings																	
Electricity		$89,300	$91,086	$92,908	$94,766	$96,661	$98,594	$100,566	$102,578	$104,629	$106,722	$108,856	$111,033	$113,254	$115,519	$117,829	$120,186
Maintenance		$7,200	$7,344	$7,491	$7,641	$7,794	$7,949	$8,108	$8,271	$8,436	$8,605	$8,777	$8,952	$9,131	$9,314	$9,500	$9,690
Chemicals		$8,000	$8,160	$8,323	$8,490	$8,659	$8,833	$9,009	$9,189	$9,373	$9,561	$9,752	$9,947	$10,146	$10,349	$10,556	$10,767
TOTAL SAVINGS		$104,500	$106,590	$108,722	$110,896	$113,114	$115,376	$117,684	$120,038	$122,438	$124,887	$127,385	$129,933	$132,531	$135,182	$137,886	$140,643

EXPENSES

Steam Turbine Generator Set	$345,000	Complete System (as described in the proposal)
NYSERDA matching grant	-$172,500	
Startup Cost	$22,000	Complete Startup (as described in the proposal)
Installation Cost	$100,000	This is an estimate on installation
Installed Cost:	**$294,500**	

	Dec-04	Dec-04	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13	Dec-14	Dec-15	Dec-16	Dec-17	Dec-18	Dec-19
Maintenance		$2,000	$2,040	$2,081	$2,122	$2,165	$2,208	$2,252	$2,297	$2,343	$2,390	$2,438	$2,487	$2,536	$2,587	$2,639	$2,692
TOTAL EXPENSES (TAX BASIS)		$2,000	$2,040	$2,081	$2,122	$2,165	$2,208	$2,252	$2,297	$2,343	$2,390	$2,438	$2,487	$2,536	$2,587	$2,639	$2,692
GROSS MARGIN FROM OPERATION (EBITDA)	$0	$102,500	$104,550	$106,641	$108,774	$110,949	$113,168	$115,432	$117,740	$120,095	$122,497	$124,947	$127,446	$129,995	$132,595	$135,247	$137,952
- Depreciation	$0	$0	$42,071	$42,071	$42,071	$42,071	$42,071	$42,071	$42,071	$0	$0	$0	$0	$0	$0	$0	$0
EARNINGS BEFORE TAXES	$0	$102,500	$62,479	$64,570	$66,702	$68,878	$71,097	$73,360	$75,669	$120,095	$122,497	$124,947	$127,446	$129,995	$132,595	$135,247	$137,952
- State Taxes	$0	$5,638	$3,436	$3,551	$3,669	$3,788	$3,910	$4,035	$4,162	$6,605	$6,737	$6,872	$7,010	$7,150	$7,293	$7,439	$7,587
- Federal Taxes	$0	$35,875	$21,868	$22,599	$23,346	$24,107	$24,884	$25,676	$26,484	$42,033	$42,874	$43,731	$44,606	$45,498	$46,408	$47,336	$48,283
NET INCOME	**$0**	**$60,988**	**$37,175**	**$38,419**	**$39,688**	**$40,982**	**$42,303**	**$43,649**	**$45,023**	**$71,457**	**$72,886**	**$74,343**	**$75,830**	**$77,347**	**$78,894**	**$80,472**	**$82,081**
+ Depreciation	$0	$0	$42,071	$42,071	$42,071	$42,071	$42,071	$42,071	$42,071	$0	$0	$0	$0	$0	$0	$0	$0
AFTER TAX NET CASH FLOW	**-$294,500**	**$60,988**	**$79,246**	**$80,490**	**$81,759**	**$83,054**	**$84,374**	**$85,721**	**$87,094**	**$71,457**	**$72,886**	**$74,343**	**$75,830**	**$77,347**	**$78,894**	**$80,472**	**$82,081**

$286,817.11

25%

$286,817.11	**Net Present Value at 10%**
3.94	**Year Payback**
25%	**IRR**

Darren’s Formulas:

South Glens Falls, New York, USA														
Turbosteam														
Assumptions														
Annual Electrical Savings	89300													
Average price of electricity in 2003 (per kwh)	0.07													
KWh saved per year	=B4/(B5)													
Inflation	Electricity	0.02												
	Maintenance	0.02												
	H2O Chemicals	0.02												
Discount Rate for Net Present Value	0.1													
Depreciation Life (tax)	7 year straight line													
Federal Tax Rate	0.35													
State Marginal Tax Rate	0.055													
Year ending:	38352	38352	=C14+365	=D14+365	=E14+365	=F14+365	=G14+365	=H14+365	=I14+365	=J14+365	=K14+365	=L14+365	=M14+365	=N14+365
Savings														
Electricity		89300	=C16*(1+$C$7)	=D16*(1+$C$7)	=E16*(1+$C$7)	=F16*(1+$C$7)	=G16*(1+$C$7)	=H16*(1+$C$7)	=I16*(1+$C$7)	=J16*(1+$C$7)	=K16*(1+$C$7)	=L16*(1+$C$7)	=M16*(1+$C$7)	=N16*(1+$C$7)
Maintenance		7200	=C17*(1+$C$8)	=D17*(1+$C$7)	=E17*(1+$C$7)	=F17*(1+$C$7)	=G17*(1+$C$7)	=H17*(1+$C$7)	=I17*(1+$C$7)	=J17*(1+$C$7)	=K17*(1+$C$7)	=L17*(1+$C$7)	=M17*(1+$C$7)	=N17*(1+$C$7)
Chemicals		8000	=C18*(1+$C$9)	=D18*(1+$C$9)	=E18*(1+$C$9)	=F18*(1+$C$9)	=G18*(1+$C$9)	=H18*(1+$C$9)	=I18*(1+$C$9)	=J18*(1+$C$9)	=K18*(1+$C$9)	=L18*(1+$C$9)	=M18*(1+$C$9)	=N18*(1+$C$9)
TOTAL SAVINGS		=SUM(C16:C18)	=SUM(D16:D18)	=SUM(E16:E18)	=SUM(F16:F18)	=SUM(G16:G18)	=SUM(H16:H18)	=SUM(I16:I18)	=SUM(J16:J18)	=SUM(K16:K18)	=SUM(L16:L18)	=SUM(M16:M18)	=SUM(N16:N18)	=SUM(O16:O18)
EXPENSES														
Steam Turbine Generator Set	345000	**Complete Syste**												
NYSERDA matching grant	-172500													
Startup Cost	22000	**Complete Startu**												
Installation Cost	100000	**This is an estima**												
Installed Cost:	**=SUM(B24:B27)**													
Maintenance		2000	=C29*(1+$C$8)	=D29*(1+$C$8)	=E29*(1+$C$8)	=F29*(1+$C$8)	=G29*(1+$C$8)	=H29*(1+$C$8)	=I29*(1+$C$8)	=J29*(1+$C$8)	=K29*(1+$C$8)	=L29*(1+$C$8)	=M29*(1+$C$8)	=N29*(1+$C$8)
TOTAL EXPENSES (TAX BASIS)		=C29	=D29	=E29	=F29	=G29	=H29	=I29	=J29	=K29	=L29	=M29	=N29	=O29
GROSS MARGIN FROM OPERATION (EBITDA)	=B21-B30	=C21-C30	=D21-D30	=E21-E30	=F21-F30	=G21-G30	=H21-H30	=I21-I30	=J21-J30	=K21-K30	=L21-L30	=M21-M30	=N21-N30	=O21-O30
- Depreciation	0	0	=(B28)/7	=D34	=E34	=F34	=G34	=H34	=I34	0	0	0	0	0
EARNINGS BEFORE TAXES	=B32-B34	=C32-C34	=D32-D34	=E32-E34	=F32-F34	=G32-G34	=H32-H34	=I32-I34	=J32-J34	=K32-K34	=L32-L34	=M32-M34	=N32-N34	=O32-O34
- State Taxes	=B36*5.5%	=C36*$B$13	=D36*$B$13	=E36*$B$13	=F36*$B$13	=G36*$B$13	=H36*$B$13	=I36*$B$13	=J36*$B$13	=K36*$B$13	=L36*$B$13	=M36*$B$13	=N36*$B$13	=O36*$B$13
- Federal Taxes	=B36*35%	=C36*$B$12	=D36*$B$12	=E36*$B$12	=F36*$B$12	=G36*$B$12	=H36*$B$12	=I36*$B$12	=J36*$B$12	=K36*$B$12	=L36*$B$12	=M36*$B$12	=N36*$B$12	=O36*$B$12
NET INCOME	**=B36-B38-B39**	**=C36-C38-C39**	**=D36-D38-D39**	**=E36-E38-E39**	**=F36-F38-F39**	**=G36-G38-G39**	**=H36-H38-H39**	**=I36-I38-I39**	**=J36-J38-J39**	**=K36-K38-K39**	**=L36-L38-L39**	**=M36-M38-M39**	**=N36-N38-N39**	**=O36-O38-O39**
+ Depreciation	=B34	=C34	=D34	=E34	=F34	=G34	=H34	=I34	=J34	=K34	=L34	=M34	=N34	=O34
AFTER TAX NET CASH FLOW	**=B41+B43**	**=C41+C43**	**=D41+D43**	**=E41+E43**	**=F41+F43**	**=G41+G43**	**=H41+H43**	**=I41+I43**	**=J41+J43**	**=K41+K43**	**=L41+L43**	**=M41+M43**	**=N41+N43**	**=O41+O43**
+ Taxes	=SUM(B38:B39)	=SUM(C38:C39)	=SUM(D38:D39)	=SUM(E38:E39)	=SUM(F38:F39)	=SUM(G38:G39)	=SUM(H38:H39)	=SUM(I38:I39)	=SUM(J38:J39)	=SUM(K38:K39)	=SUM(L38:L39)	=SUM(M38:M39)	=SUM(N38:N39)	=SUM(O38:O39)
PRE-TAX CASH FLOW	**=-1*(B28)**	**=C45+C47**	**=D45+D47**	**=E45+E47**	**=F45+F47**	**=G45+G47**	**=H45+H47**	**=I45+I47**	**=J45+J47**	**=K45+K47**	**=L45+L47**	**=M45+M47**	**=N45+N47**	**=O45+O47**
=NPV(B10,C45:R45)	**="Net Present **													
=(B28)/(C21-C29)	**Year Payback**													
=IRR(B49:R49,15%)	**ROA**													

Issues with Darren’s NPV analysis:

- Note the treatment of depreciation – correctly affects taxes
- <u>Nominal</u>, real, or inconsistent analysis?
- No defense of the discount rate
- Inflation assumptions probably OK, but all at 2%?
- Where are the risks? (upfront costs…) Did he treat them appropriately? (ignored them)
- Did he use <u>optimistic</u>, pessimistic, or middle-of the road figures? (E.g., depreciation, installation,…) What should he have done? (middle)
- Given that the cash flows are savings in energy costs, should the discount rate be higher, lower, or the same as the firms’ overall cost of capital? (Arguably higher, positive beta)
- Which are the most important assumptions? (experiment)
- Mistake in computing NPV: Forgot initial cost
- Mistake in computing IRR (ROA): Used the wrong cash flows
- Mistake in computing payback: Didn’t use after-tax cash flows

"Even if your fancy NPV analysis is correct…" How to deal with various forms of opposition?

- If it is such a good idea, why aren't our smart competitors doing it?
- Adding complexity ALWAYS adds risk, and your savings (EBITDA) can only amount to 2% of revenue – lost in the noise!
- We are only given a limited amount to invest, and we always focus on increasing capacity; that's how we grow the business!
- Our bonuses depend on production, and this project will involve downtime. We might not be able to recover from it!
- Policies related to distributed generation (like the kill switch requirement, ability to sell excess power) and others are still in flux – let's wait until the dust settles.
- Is there a positive spin that Darren can put on this project to sell it despite these objections? What kinds of thinking do they reflect?
- What public policy changes would help this project most?