#050879
3/6/06

ICF CONSULTING

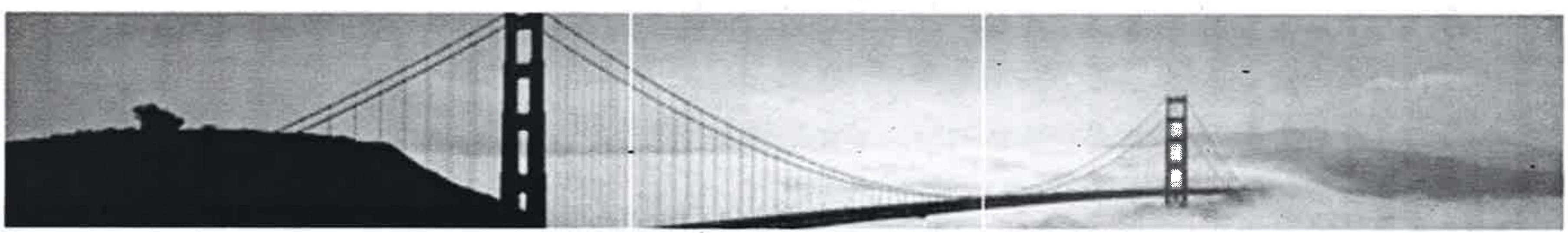
Options for Meeting the Electrical Supply Needs of Gainesville - FINAL

Prepared for:
The City of Gainesville

Prepared by:
ICF Consulting

March 6, 2006

ICF Consulting. Powered by perspective.
Industry knowledge. Distinguished professionals. Innovative analytics.



Outline

- Options Analyzed
- DSM and Capacity Needs
- Biomass
- Revenue Requirements
- Rate Impacts
- Emissions and Health
- Local Socio-economic Impacts
- Additional DSM Discussion
- Conclusions

Options

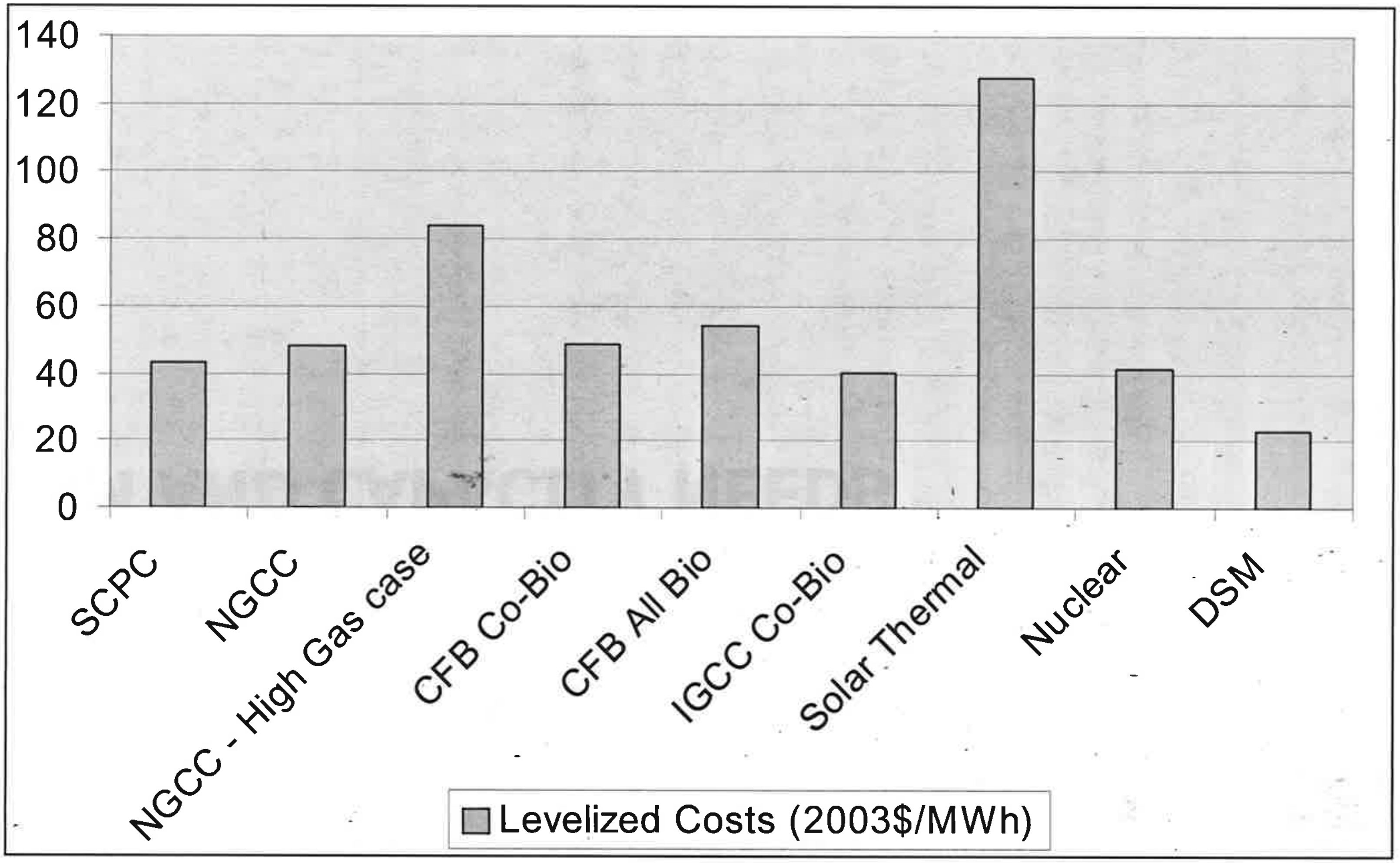
Four GRU Options Analyzed

ICF CONSULTING

- **220 MW CFB** – Likely online 2012. Fluidized Bed Combustion (CFB) power plant capable of using coal, petroleum coke, and up to 30 MW of Biomass (same as GRU IRP choice whose analysis is required under ICF's contract)[1].
- **220 MW IGCC** – Integrated Gasification Combined Cycle (IGCC) power plant using coal, petroleum coke, and up to 30 MW of Biomass (advanced coal technology option similar to Tampa's Polk IGCC).
- **"Maximum" DSM** – A set of DSM programs are specified which are economic under high natural gas price and CO_2 allowance price scenarios with residual incremental power needs, if any, met via a least cost combination of GRU plants and short-term wholesale power purchases.
- **75 MW Biomass Plus Maximum DSM** – Has a similar technology as the 220 MW CFB.

DSM AND CAPACITY NEEDS

Average Costs of Various Build Options Shows DSM as Part of Any Plan and IGCC Costs as Attractive (2003$/MWh)



Maximum DSM Effects on GRU Supply and Peak Demand Balance (MW) – Base Case Demand Growth

ICF CONSULTING

Year	Before DSM				DSM Effects	After DSM		
	Peak Demand	Peak Demand Plus Reserve Require-ments	Existing Capacity Net of Retire-ments[1]	Deficit/ Surplus Relative to Existing Capacity	Decrease in Peak Demand	Peak Demand	Peak Demand Plus Reserve Requirements	Deficit/ Surplus Relative to Existing Capacity
2006	470	541	611	71	4	466	536	75
2007	483	555	611	56	6	477	549	62
2008	495	569	611	42	7	488	561	50
2009	508	584	611	27	11	497	572	39
2010	520	598	602	4	15	505	580	22
2011	**532**	**612**	**579**	**-32**	**21**	**511**	**588**	**-9**
2012	**544**	**626**	**579**	**-46**	**27**	**517**	**594**	**-15**
2013	**556**	**639**	**579**	**-60**	**34**	**522**	**600**	**-21**
2014	**569**	**654**	**579**	**-75**	**42**	**527**	**607**	**-27**
2015	**580**	**667**	**579**	**-88**	**49**	**531**	**611**	**-31**
2016	592	681	579	-102	54	538	619	-40
2017	603	693	579	-115	59	544	625	-47

Maximum DSM Effects on GRU Supply and Peak Demand Balance (MW) – Base Case Demand Growth (continued)

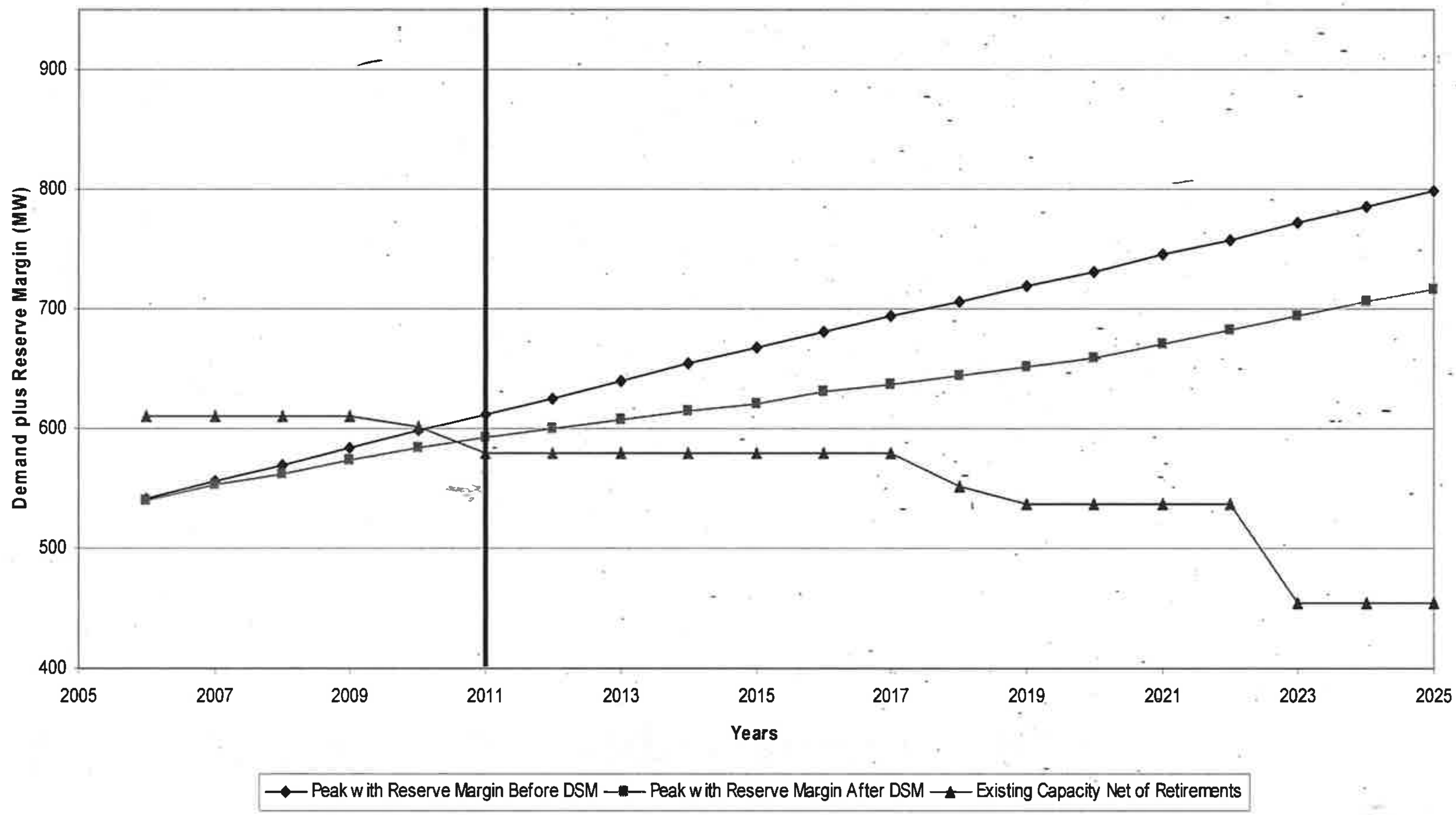
ICF CONSULTING

Year	Before DSM				DSM Effects	After DSM		
	Peak Demand	Peak Demand Plus Reserve Require-ments	Existing Capacity Net of Retire-ments[1]	Deficit/ Surplus Relative to Existing Capacity	Decrease in Peak Demand	Peak Demand	Peak Demand Plus Reserve Requirements	Deficit/ Surplus Relative to Existing Capacity
2017	603	693	579	-115	59	544	625	-47
2018	614	706	551	-155	65	549	631	-80
2019	625	719	537	-182	72	553	636	-100
2020	636	731	537	-195	79	557	641	-104
2021	648	745	537	-209	81	567	652	-116
2022	659	758	537	-221	83	576	663	-126
2023	671	772	454	-318	84	587	674	-221
2024	683	785	454	-332	86	597	686	-232
2025	694	798	454	-344	88	606	696	-243

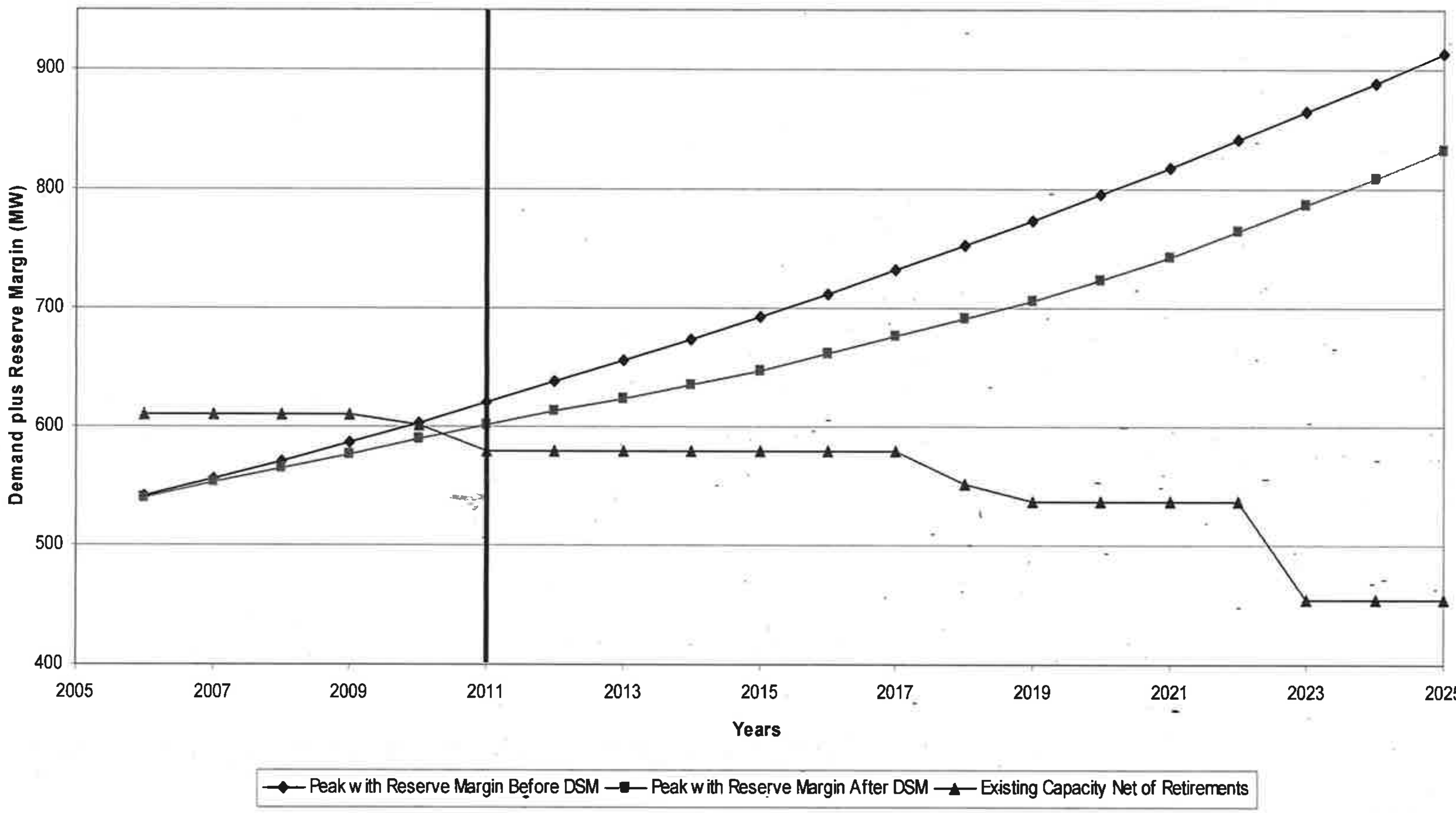
[1] 15% reserve margin.

Maximum DSM Effects on GRU Supply and Demand Balance – Base Case

ICF CONSULTING



Maximum DSM Effects on GRU Supply and Demand Balance – High Demand Case



Net Import for Base Case Assumptions (GWh)

ICF CONSULTING

Year	CFB	IGCC	Biomass Maximum DSM	Maximum DSM
2006	+148	+148	+137	+137
2007	+156	+156	+141	+141
2008	+163	+163	+145	+145
2009	+185	+185	+157	+157
2010	+275	+275	+230	+230
2011	-715	-760	+245	+738
2012	-701	-745	+238	+748
2013	-687	-729	+231	+758
2014	-665	-700	+196	+703
2015	-642	-670	+161	+647
2016	-365	-455	+206	+711
2017	-207	-309	+264	+780
2018	-118	-210	+338	+857
2019	-67	-143	+433	+941
2020	-38	-97	+554	+1,034
2021	+63	-7	+596	+1,080
2022	+163	+84	+641	+1,128
2023	+264	+174	+689	+1,178
2024	+364	+265	+741	+1,230
2025	+465	+355	+797	+1,285
Average 2006 – 2025	-98	-151	+357	+731

- means export
+ means import

Base Case GRU Capacity Expansion Reflects Growth – 2006 – 2025 (MW)

ICF CONSULTING

Resource Type	Option			
	CFB	IGCC	Biomass Maximum DSM	Maximum DSM
CFB	220	--	--	--
IGCC	--	220	--	--
Biomass Only CFB	--	--	75	--
Peaking Combustion Turbine	159	141	174	249
Capacity Import – 2025	29	29	29	29
DSM – 2025	--	--	88	88
Total	408	390	366	366

Planning for Additional Resources Needed Soon

ICF CONSULTING

- In the event that GRU decides not to pursue a supply side resource, planning should begin immediately to provide for additional capacity imports, including potential transmission upgrades or combustion turbine peaking plants.

Biomass

CO_2 Price Forecast (2003 $/Ton)[1]

ICF CONSULTING

Year	Low Case	Base Case	High Case
2010	0	0	15.5
2016	0	7.7	24
2020	0	13.4	26.4
2025	0	21.7	30
Average 2010-2025	0	10.7	24.0

[1] Gross, not net of allocation

Base Case Fuel Consumption provides C02 hedge (1,000 Tons)

ICF CONSULTING

Year	CFB			IGCC			75 MW Biomass Maximum DSM		Maximum DSM
	Coal	Pet Coke	Biomass	Coal	Pet Coke	Biomass	Coal	Biomass	Coal
2006	665	0	0	665	0	0	665	0	665
2007	665	0	0	665	0	0	665	0	665
2008	665	0	0	665	0	0	665	0	665
2009	669	0	0	669	0	0	669	0	669
2010	700	0	0	700	0	0	700	0	700
2011	906	256	162	861	221	114	592	418	600
2012	920	256	162	875	221	114	602	432	610
2013	934	256	162	889	221	114	612	447	620
2014	938	253	175	892	217	127	622	447	630
2015	942	250	188	895	213	140	632	447	640
2016	908	235	215	865	202	162	620	447	628
2017	875	222	244	836	191	187	609	447	615
2018	844	209	278	808	181	217	598	447	603

Base Case Fuel Consumption Provides CO_2 Hedge (1,000 Tons) (continued)

ICF CONSULTING

Year	CFB			IGCC			75 MW Biomass Maximum DSM		Maximum DSM
	Coal	Pet Coke	Biomass	Coal	Pet Coke	Biomass	Coal	Biomass	Coal
2019	813	197	317	780	171	251	587	447	592
2020	784	185	361	754	162	290	576	447	580
2021	728	148	440	724	133	337	572	447	576
2022	677	111	536	696	109	391	568	447	572
2023	630	74	653	668	89	455	564	447	568
2024	585	37	796	642	73	528	560	447	564
2025	544	0	971	617	60	614	556	447	560

Scaling and Biomass

Comparison of Selected Power Station Technologies (2003$/kW) – GRU[3]

ICF CONSULTING

Size (MW)	SCPC		CFB		IGCC		CFB (100% Biomass)		NGCC	
	GF[1]	BF[2]	GF[1]	BF[2]	GF[1]	BF[2]	GF[1]	BF[2]	GF[1]	BF[2]
800	1,503	1,353	1,568	1,411	1,698	1,529	1,716	1,545	426	383
500	1,747	1,572	1,822	1,640	1,974	1,777	1,960	1,764	470	423
220	1,991	1,792	2,372	2,135	2,250	2,025	2,548	2,293	588	529
75	2,072	1,865	2,555	2,300	3,538	3,184	2,745	2,470	925	832

[1]GF = Greenfield
[2]BF = brownfield
[3]Project contingency fees are included in costs. They are 6, 8, 10, and 20% for NGCC, CFB, SCPC, and IGCC, respectively.

Expected Revenue Requirements

Base Case[2] Revenue Requirements Lowest for IGCC (Nominal MM$)

ICF CONSULTING

Option	NPV 2006 - 2025[1]	Incremental NPV	% Incremental NPV
IGCC	2,935	--	--
CFB	3,099	+164	+6
Biomass Maximum DSM	3,107	+172	+6
Maximum DSM	3,139	+204	+7

[1] 5.5 percent nominal discount rate.

[2] Base Demand, Base Fuel, Base CO_2, Base Biomass.

Grid-Wide[1] New Power Plant Construction – Cumulative MW – 2006-2025

	Coal/Solid Fuel				Nuclear	Natural Gas	Biomass	Other / Renewable[3]	Total
Case[2]	SCPC	IGCC	CFB	Total					
Base	194	37,845	-	38,039	10,543	26,152	-	619	75,353
Base No CO_2	21,096	32,936	-	54,032	7,543	14,465	-	557	76,597
Base High CO_2	-	17,970	-	17,970	10,543	46,141	90	619	75,363
Base Low Gas	-	-	-	-	7,543	65,641	-	555	73,739

[1] Florida and Southern Company
[2] Maximum DSM
[3] Other includes DSM, Landfill Gas, Solar and Wind

Revenue Requirements – IGCC Sensitivity 2006-2025 (Nominal MM$)

ICF CONSULTING

Case	NPV
Base Case	2,935
High IGCC Capital Cost - +$534/kW over Base Case	2,981 (+46)

IGCC and CFB Needs to be Pursued in Parallel

ICF CONSULTING

- IGCC costs and performance may not be attractive as estimated. Quotations should be requested for at least two solid fuel options if a decision is made to go forward with IGCC.

Revenue Requirement Risks

Delivered Utility Fuel Price Volatility Compared to Henry Hub Natural Gas Price – U.S. Average

ICF CONSULTING

Year	Nominal$/MMBtu		
	Coal – U.S. Average Delivered Utility Cost[1]	Gas – U.S. Average Delivered Utility Cost[1]	Henry Hub Spot Gas Price[2]
1995	1.32	1.98	1.72
1996	1.29	2.64	2.81
1997	1.27	2.76	2.48
1998	1.25	2.38	2.08
1999	1.22	2.57	2.29
2000	1.20	4.30	4.70
2001	1.23	4.49	3.70
2002	1.26	3.56	3.02
2003	1.28	5.39	5.46
2004	1.36	5.96	5.90
Average	1.27	3.60	3.42
Standard Deviation	0.05	1.37	1.47
Correlation Coefficient with Henry Hub	21%	97%	--

[1]Source: EIA Electric Power Annual Table 4.5
[2]Source: Platts' Gas Daily. Prices from 1995 onwards are volume-weighted averages.

Coal Price Volatility

Year	Spot Coal Prices[1] (Nominal$/MMBtu)		Average Delivered Coal Costs to Utilities (Nominal$/MMBtu)	
	PRB	Central Appalachia 1% Sulfur	GRU[2]	U.S.[3]
1995	0.27	0.87	1.73	1.32
1996	0.23	1.05	1.66	1.29
1997	0.25	1.02	1.66	1.27
1998	0.26	1.08	1.66	1.25
1999	0.27	1.02	1.66	1.22
2000	0.26	0.99	1.62	1.20
2001	0.57	1.72	1.88	1.23
2002	0.35	1.17	2.06	1.26
2003	0.36	1.40	2.04	1.28
2004	0.36	2.27	2.03	1.36
Standard Deviation	0.10	0.43	0.18	0.05
Correlation with Gas Prices	0.37	0.73	0.59	0.21

[1] Source: Coal Outlook
[2] Source: A Review of Florida Electric Utility 2005 Ten-Year Site Plans, prepared by the Florida Public Service Commission, Division of Economic Regulation, December 2005, p.48
[3] Source: EIA AEO 2005

Sensitivity to Wholesale Power Market Conditions – NPV Revenue Requirements 2006-2025[1] – Selected Cases and Options

ICF CONSULTING

Scenario	Option	
	CFB	Maximum DSM
Base	3,099	3,139
Base – No Coal or Nuclear Builds[3]	3,016	3,112
Base – No Coal or Nuclear Builds – High Gas Price[3]	2,939	3,217
Base – No Coal or Nuclear Builds – Extremely High Gas Price[2,3]	2,812	3,514

[1] 5.4% Nominal discount rate

[2] Two standard deviation increase in gas prices over Base Case with historical standard scaled for higher mean gas prices. Much more likely for one year than on average for period.

[3] Otherwise Base conditions.

Revenue Requirements No CO_2 (Nominal MM$)[1] – Average of All 12 No CO_2 Cases (Change From Average of all 36 Cases)

ICF CONSULTING

Period	CFB	IGCC	Biomass Maximum DSM	Maximum DSM
2006 – 2025	3,046 (-172)	2,931 (-124)	3,061 (-186)	2,986 (-250)

[1]Includes generation going forward production costs only.

Revenue Requirements - Change From Least Cost Option – Average of All 12 No CO_2 Cases (Nominal MM$)[1]

ICF CONSULTING

Period	CFB	IGCC	Biomass Maximum DSM	Maximum DSM
2006 – 2025	+115	--	+130	+55

[1]Includes generation going forward production costs only.

Potential Revenue Requirements Risk

Option	Potential Risk
CFB	Low Gas Prices, High CO_2
IGCC	Capital and Operations
Biomass	Delivered Costs, Operations, Low CO_2
Maximum DSM	Implementation, High Purchase Power Costs and Volatility

Bill Impacts

Per MWh Base Case Revenue Requirements (Nominal $/MWh)[1]

ICF CONSULTING

Year	CFB			IGCC			Biomass Maximum DSM			Maximum DSM		
	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric
2006	45.2	36.3	81.5	45.2	36.3	81.5	45.1	36.5	81.6	45.1	36.5	81.6
2007	45.4	36.0	81.4	45.4	36.0	81.4	45.2	36.3	81.5	45.2	36.3	81.5
2008	45.5	35.8	81.3	45.5	35.8	81.3	45.3	36.1	81.4	45.3	36.1	81.4
2009	48.6	35.5	84.1	48.6	35.5	84.1	48.5	36.0	84.5	48.5	36.0	84.5
2010	56.5	35.0	91.5	56.5	35.0	91.5	56.3	35.7	92.0	56.3	35.7	92.0
2011	54.8	34.1	88.8	48.4	34.1	82.5	60.1	34.9	95.0	57.9	34.9	92.8
2012	56.7	34.7	91.5	50.0	34.7	84.8	62.3	35.9	98.2	60.6	35.9	96.5
2013	58.6	35.4	94.1	51.7	35.4	87.1	64.6	36.9	101.4	63.3	36.9	100.2
2014	61.3	35.6	96.9	54.1	35.6	89.8	67.1	37.4	104.4	66.0	37.4	103.4
2015	64.1	35.9	100.0	56.7	35.9	92.6	69.7	38.0	107.7	69.0	38.0	107.0
2016	67.1	36.2	103.4	59.7	36.2	95.9	73.1	38.5	111.6	72.5	38.5	111.0
2017	70.5	36.6	107.1	62.9	36.6	99.5	76.8	39.0	115.9	76.3	39.0	115.4
2018	74.0	37.0	111.1	66.4	37.0	103.4	80.8	39.7	120.5	80.5	39.7	120.1
2019	77.8	37.5	115.3	70.1	37.5	107.6	85.1	40.4	125.5	84.9	40.4	125.3
2020	81.8	37.9	119.7	74.1	37.9	112.0	89.7	41.1	130.8	89.7	41.1	130.8
2021	85.8	38.4	124.2	77.8	38.4	116.3	93.7	41.7	135.4	93.8	41.7	135.5
2022	89.9	39.0	128.9	81.8	39.0	120.8	97.8	42.3	140.1	98.2	42.3	140.5
2023	94.3	39.6	133.9	86.0	39.6	125.6	102.1	43.0	145.1	102.8	43.0	145.8
2024	99.0	40.2	139.2	90.4	40.2	130.6	106.7	43.7	150.4	107.6	43.7	151.3
2025	103.9	40.9	144.8	95.1	40.9	136.0	111.5	44.4	155.9	112.8	44.4	157.2
Average 2006 – 2025	69.0	36.9	105.9	63.3	36.9	100.2	74.1	38.9	112.9	73.8	38.9	112.7

Per MWh Base Case Revenue Requirements (Nominal $/MWh)

ICF CONSULTING

Year	CFB			IGCC			Biomass Maximum DSM			Maximum DSM		
	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric
2006	45.2	36.3	81.5	45.2	36.3	81.5	44.8	36.3	81.1	44.8	36.3	81.1
2007	45.4	36.0	81.4	45.4	36.0	81.4	44.9	36.0	80.9	44.9	36.0	80.9
2008	45.5	35.8	81.3	45.5	35.8	81.3	44.9	35.8	80.7	44.9	35.8	80.7
2009	48.6	35.5	84.1	48.6	35.5	84.1	47.9	35.5	83.3	47.8	35.5	83.3
2010	56.5	35.0	91.5	56.5	35.0	91.5	55.3	35.0	90.3	55.3	35.0	90.3
2011	54.8	34.1	88.8	48.4	34.1	82.5	58.6	34.1	92.7	56.4	34.1	90.5
2012	56.7	34.7	91.5	50.0	34.7	84.8	60.3	34.7	95.1	58.6	34.7	93.4
2013	58.6	35.4	94.1	51.7	35.4	87.1	62.1	35.4	97.5	60.8	35.4	96.3
2014	61.3	35.6	96.9	54.1	35.6	89.8	64.0	35.6	99.6	63.0	35.6	98.6
2015	64.1	35.9	100.0	56.7	35.9	92.6	66.0	35.9	101.9	65.3	35.9	101.2
2016	67.1	36.2	103.4	59.7	36.2	95.9	68.9	36.2	105.2	68.4	36.2	104.6
2017	70.5	36.6	107.1	62.9	36.6	99.5	72.1	36.6	108.7	71.6	36.6	108.2
2018	74.0	37.0	111.1	66.4	37.0	103.4	75.4	37.0	112.5	75.1	37.0	112.1
2019	77.8	37.5	115.3	70.1	37.5	107.6	79.0	37.5	116.5	78.8	37.5	116.3
2020	81.8	37.9	119.7	74.1	37.9	112.0	82.8	37.9	120.7	82.7	37.9	120.6
2021	85.8	38.4	124.2	77.8	38.4	116.3	86.4	38.4	124.8	86.5	38.4	125.0
2022	89.9	39.0	128.9	81.8	39.0	120.8	90.1	39.0	129.1	90.5	39.0	129.5
2023	94.3	39.6	133.9	86.0	39.6	125.6	94.1	39.6	133.7	94.7	39.6	134.3
2024	99.0	40.2	139.2	90.4	40.2	130.6	98.3	40.2	138.5	99.1	40.2	139.3
2025	103.9	40.9	144.8	95.1	40.9	136.0	102.6	40.9	143.5	103.8	40.9	144.6
Average 2006 – 2025	69.0	36.9	105.9	63.3	36.9	100.2	69.9	36.9	106.8	69.7	36.9	106.6

Per MWh Base Case Revenue Requirements (Nominal $/Customer)

ICF CONSULTING

Year	CFB			IGCC			Biomass Maximum DSM			Maximum DSM		
	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric	Cash Production	Other Revenue	Total Electric
2006	1093	878	1971	1093	878	1971	1084	878	1962	1084	878	1962
2007	1103	876	1979	1103	876	1979	1091	876	1968	1091	876	1968
2008	1114	875	1989	1114	875	1989	1100	875	1974	1100	875	1974
2009	1197	874	2070	1196	874	2070	1178	874	2052	1178	874	2052
2010	1399	867	2266	1399	867	2266	1369	867	2236	1369	867	2236
2011	1362	847	2209	1204	847	2051	1458	847	2305	1403	847	2251
2012	1417	868	2285	1250	868	2119	1508	868	2376	1465	868	2333
2013	1473	890	2363	1298	890	2188	1559	890	2449	1528	890	2418
2014	1548	901	2449	1367	901	2268	1616	901	2517	1592	901	2493
2015	1603	899	2503	1419	899	2318	1652	899	2551	1635	899	2534
2016	1665	899	2563	1479	899	2378	1709	899	2608	1695	899	2593
2017	1729	898	2627	1543	898	2441	1768	898	2666	1757	898	2655
2018	1795	898	2693	1610	898	2508	1830	898	2728	1822	898	2720
2019	1865	898	2763	1681	898	2579	1894	898	2792	1889	898	2787
2020	1938	898	2836	1755	898	2653	1961	898	2858	1960	898	2857
2021	2007	900	2907	1822	900	2722	2022	900	2921	2025	900	2925
2022	2080	902	2982	1892	902	2794	2085	902	2987	2093	902	2995
2023	2155	905	3060	1964	905	2869	2150	905	3055	2164	905	3069
2024	2234	908	3142	2040	908	2948	2218	908	3126	2237	908	3145
2025	2316	911	3227	2120	911	3031	2288	911	3199	2313	911	3224
Average 2006 – 2025	1655	890	2544	1518	890	2407	1677	890	2567	1670	890	2560

Emissions and Health

Cumulative CO_2 Emissions (Million tons) – Average Across 36 Cases – 2006-2025

ICF CONSULTING

Source	Option			
	CFB	IGCC	Biomass Maximum DSM	Maximum DSM
GRU	45	43	29	30
Total Grid[1]	7,567	7,565	7,559	7,563

[1]Florida plus Southern Company region.

Cumulative SO_2 Emissions (Thousand tons) – Average Across 36 Cases – 2006-2025[2]

ICF CONSULTING

Source	Option			
	CFB	IGCC	Biomass Maximum DSM	Maximum DSM
GRU	49	48	40-44	40
Total Grid[1]	12,383	12,381	12,379	12,380

[1] Florida plus Southern Company region
[2] Note, a large portion of the total emisions of SO_2 are in the 2006-2010 time Period before the Deerhaven 2 retrofits are complete. This also applies to NO_X

Cumulative NO_x Emissions (thousand tons) – Average Across 36 Cases – 2006-2025

Source	Option			
	CFB	IGCC	Biomass Maximum DSM	Maximum DSM
GRU	38	33	32	32
Total Grid[1]	3,758	3,753	3,754	3,754

[1]Florida plus Southern Company region.

Cumulative HG Emissions (thousand tons) – Average Across 36 Cases – 2006-2025

ICF CONSULTING

Source	Option			
	CFB	IGCC	Biomass Maximum DSM	Maximum DSM
GRU	1	1	1	1
Total Grid[1]	150.07	150.12	150.10	150.10

[1] Florida plus Southern Company region.

Socio-economic and Jobs

Jobs

ICF CONSULTING

Option	Construction Jobs – Total[1]	Operations Jobs – Total[1]	Total Job Years[2]	Total Job Equivalents[3]
CFB	1,858	192	13,192	388
IGCC	1,759	165	11,986	353
Biomass + DSM – High[4]	672[5]	470[5]	18,288	569
Max DSM only[6]	---	---	1,500	75

[1] Total includes jobs directly required for construction and operation of the various plant options, as well as their multiplier impacts (indirect and induced jobs).
[2] Assumes 4 years during construction and 30 years of operations for the generation options and 20 years for DSM.
[3] Expressed as total number of continuous jobs available for the entire period of the analysis.
[4] High includes all jobs needed for the entire biomass supply, including those in neighboring counties.
[5] Includes construction and operations jobs for biomass plant only. Does not include DSM operation jobs.
[6] DSM option does not entail construction of any power plant. Hence the jobs created by this option should be interpreted as jobs in the local economy for all the DSM programs modeled in IPM.

Additional DSM

1. GDS' assertion that ICF's 4.2% reduction in energy from DSM is "unrealistically low" compared to other utilities is wrong in both its calculation and implication

ICF CONSULTING

- The 4.2% cited by GDS (which is itself a snapshot) is inaccurate and includes only the incremental DSM programs found to be cost-effective. For a meaningful comparison with other utilities, the savings from GRU's ongoing programs (delivered in 2005 at an average cost of $38.79/MWh) must be included.
- If these programs are included, and using the latest updates to the ICF report, the 2015 savings are 8.3%, and increase to 11.5% over time. By GDS' metrics, this would make GRU's savings the largest in Florida and (using the 8.3%) 15th out of 234 utilities cited by GDS (i.e., in the top 6%)

Year	Before New DSM GWh	After New DSM GWh	New DSM Savings GWh	New DSM Savings %	GRU DSM Savings GWh	GRU DSM Savings %	Combined DSM GWh Savings	Combined DSM GWh Savings %
2006	2177	2165	12	0.6%	43	2.0%	55	2.5%
2007	2233	2217	16	0.7%	46	2.1%	62	2.8%
2008	2291	2270	21	0.9%	49	2.2%	70	3.1%
2009	2349	2318	31	1.3%	52	2.2%	83	3.6%
2010	2407	2362	45	1.9%	55	2.3%	100	4.2%
2011	2460	2399	61	2.5%	57	2.4%	118	4.9%
2012	2514	2434	80	3.3%	60	2.5%	140	5.8%
2013	2570	2470	100	4.0%	62	2.5%	162	6.6%
2014	2627	2506	121	4.8%	65	2.6%	186	7.4%
2015	2679	2536	143	5.6%	67	2.6%	210	8.3%
2016	2732	2572	160	6.2%	69	2.7%	229	8.9%
2017	2783	2606	177	6.8%	71	2.7%	248	9.5%
2018	2833	2639	194	7.4%	73	2.8%	267	10.1%
2019	2883	2673	210	7.9%	75	2.8%	285	10.7%
2020	2933	2706	227	8.4%	77	2.8%	304	11.2%
2021	2984	2751	233	8.5%	79	2.9%	312	11.3%
2022	3036	2798	238	8.5%	81	2.9%	319	11.4%
2023	3088	2845	243	8.5%	82	2.9%	325	11.4%
2024	3140	2891	249	8.6%	84	2.9%	333	11.5%

ICF CONSULTING

2. GDS' implication that ICF's estimate of DSM MWh savings by 2015 (4.2% as reported by GDS, corrected to 8.3%) in inconsistent with our results for the State of Georgia is unfounded

- The correct comparison (although comparison is difficult due to differences in the service territories) is 8.3% (GRU) vs. 8.98% (GA)
- The customer profile in GA is very different than for GRU, and includes a large industrial customer base. Our findings in GA included a significant savings from customized industrial process measures, which are not broadly applicable in Gainesville
- If anything, given Gainesville's lack of large commercial and industrial customers, the GRU estimate appears high relative to GA

3. GDS' citation of other utilities' reported savings does not support the assertion that other utilities have done "far, far more" than ICF estimates would be cost-effective for GRU

ICF CONSULTING

- As noted previously, the Max DSM case (including GRUs ongoing programs) puts GRU in the top 6% of utilities in the country
- It is not clear that the savings numbers reported by the other utilities are net of free-riders (those who would have installed the measures anyway. ICF's Max DSM case is net of free-riders.
- Of the 15 utilities that report savings greater than those projected by ICF for GRU, not one is within 1,000 miles of Gainesville. With the exception 3 California utilities, all are in very cold climates.
- For example, the #1 utility cited (with 17% savings) is the Burlington Electric Department (BED) in Burlington, Vermont. BED is very different from GRU
  - ~19,600 customers
  - Heating Degree Days of 7,771 (vs. 1,316 in Gainesville). Cooling Degree Days of 388 (vs. 2,570 in Gainesville)
  - It has been providing consistent energy efficiency services since 1991
  - Total utility spending per customer in 2004 of approximately \$75.77 (compare to \$73.16 in the Max DSM case for GRU after 9 years)
  - The measures promoted by BED are, in many instances, the measures found cost-effective by ICF for GRU
- This is not to suggest that other leading utilities, including those cited by GDS, do not offer excellent programs. We think that BED, SMUD, and others offer important experience and leadership. However, the existence of such programs generally serves to reinforce ICF's analysis of the nature and scale of cost-effective programs for GRU, not contradict it.

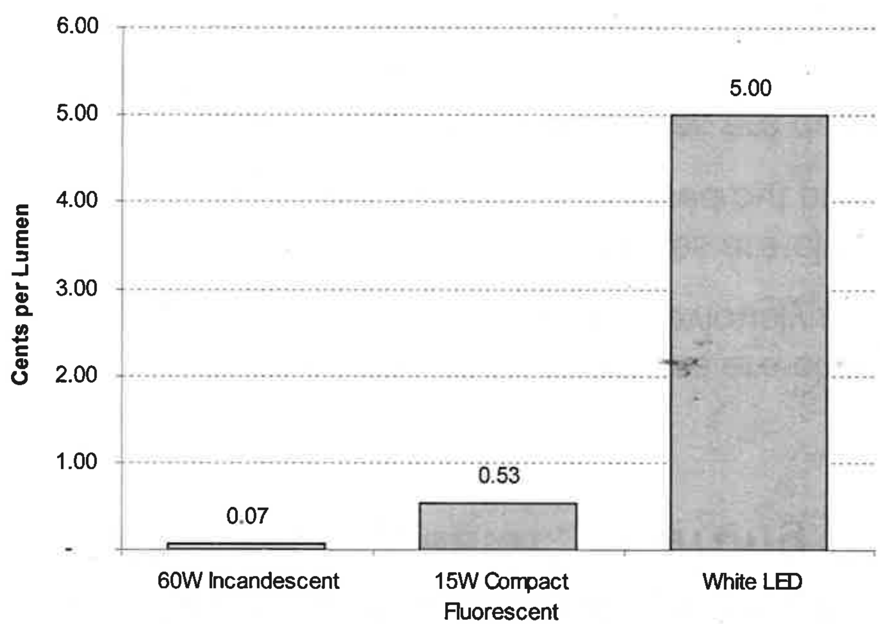
4. GDS' assertion that had ICF included certain "additional energy efficiency and load management measures and programs, the potential peak savings and kWh savings would be much, much greater" is wrong for three reasons:

ICF CONSULTING

1. Many of the cited measures are either not commercially available (and not anticipated to be any time soon) or obviously not cost-effective
2. Many of the cited measures are either included in ICF's Max DSM programs, GRU's programs, or were screened out based on poor measure cost-effectiveness
3. Many of the cited measures are duplicative of measures included in ICF's analysis. To include certain of these additional measures may be a good idea, but to suggest that the savings would be "much, much greater" is simply wrong

GDS Recommended Measure	ICF Conclusion
LED lighting in the residential sector	Not commercially available, not cost-effective. See attachment
Inefficient room air conditioner buy-back program	A promotional technique, not a measure. HE Room A/C has been included in ICF's analysis
Instantaneous electric water heaters	Obviously not cost effective given GRU's avoided costs
1 kWh/day refrigerator (for residential sector)	Duplicative of ICF's included refrigerator measures, although a possible extension of the qualifying measures list
High efficiency pool pump system	Good idea which ICF missed
Residential solar photovoltaic systems	Included in ICF's analysis - not cost-effective
Zero energy homes	Obviously not cost effective given GRU's avoided costs

4. (cont.) The GDS Measures – Not commercially available or cost-effective example



- White LEDs are 10x as expensive as CFL's per lumen
- Color consistency, efficacy, heat problems, other performance issues, and a lack of industry standards first need to be resolved by the industry.
- White LED lighting products like MR16 and recessed cans, and flood lights are unproven in the field.
- High risk for utilities that LEDs may fail and result in strong customer dissatisfaction
- Niche applications like task lamps and undercabinet lights may not offer guaranteed peak load savings due to limited use.

Conclusion – Not Commercially Available or Cost-Effective. See attachment for more detail

4. (cont.) The GDS Measures – Obviously not cost-effective example

ICF CONSULTING

- Instantaneous Electric Water Heaters (IEWH)
  - Best Case Incremental Costs (new construction)*
    - Whole House IEWH $685
    - Distributed IEWH $1,904
  - Best Case Energy Savings (high use home)*
    - Whole House IEWH 406 kWh/year
    - Distributed IEWH 1,369 kWh/year
  - Best Case $/MWh resource value
    - Whole House IEWH $113.04/MWh
    - Distributed IEWH $93.18/MWh
- Conclusion – Compared to supply side options at $40-$55/MWh IEWH are obviously not cost-effective

* Source: PERFORMANCE COMPARISON OF RESIDENTIAL HOT WATER SYSTEMS, Prepared for: National Renewable Energy Laboratory, Prepared by: NAHB Research Center, Inc. November 2002. Note that this study uses baseline energy consumption for hot water heating that is higher than that for Florida, and thus potentially overstates the savings.

4. (cont.) The GDS Measures – Duplicative example

1 kWh/day Refrigerator

- ICF included ENERGY STAR Refrigerators (~ 1.16 kWh/day) and refrigerator retirement measures
- The 1 kWh/day unit identified by GDS does indeed provide additional energy savings over the ENERGY STAR refrigerator. However, the additional savings of approximately 58.4 kWh/year may not be cost–effective. As an illustration:
  - Assume that to beat the supply side options, DSM options must cost less than $40/MWh
  - For this to be true, the 1 kWh/day unit must have an incremental cost (over the ENERGY STAR unit) of less than $34.87/unit ([$40/MWH * 0.0584 MWh] / 6.7% Capital Charge Rate. Including program design, marketing, and administration as well as any incentives)
  - It is not clear that the incremental cost is less then this threshold
- The 1 kWh/day unit is only available from limited manufacturers and does not (yet) come in the full range of sizes and options typically demanded by customers

It may be appropriate, pending further investigation of incremental cost and availability issues, to include (or even focus upon) the 1 kWh/day unit. However, ICF's analysis already includes significant measures to address refrigeration, and the fact that ICF did not explicitly include the 1 kWh/unit in its projections does not materially impact the savings estimated for Gainesville due to its limited applicability and savings.

4. (cont.) The GDS Measures – Included measure examples

ICF CONSULTING

GDS Measure	*ICF Treatment*
CFL fixtures	ICF's CFL measure is modeled as being applicable to all incandescent-type replacements. This includes fixtures, torchieres, or anything where incandescent technology is the baseline.
Fluorescent daylighting dimming controls	ICF included this measure under the name of "perimeter dimming for fluorescent"
High intensity fluorescent (HIF)	Presuming GDS is referring to replacing mercury vapor or incandescent high-bays with T5 fluorescent. ICF included analysis of metal halide primarily for this type of application, which is similarly efficient.
Pendant mounted indirect fluorescent fixtures	ICF included this under the fluorescent measures
High efficiency fluorescent fixtures	ICF included this under the fluorescent measures
Commercial T-5 lighting	T-5s are not more efficacious than T-8s. ICF used an overall fluorescent measure with electronic ballasts to represent the efficiency potential here.
Fluorescent fixtures with reflectors	ICF included this under the name "Reflectors for 4' fluorescent" and "Reflectors for 8' fluorescent"

4. (cont.) The GDS Measures – Included in the ICF analysis and found not cost-effective

ICF CONSULTING

Residential Solar PV

	ICF	FSEC*
Installed System Cost net of Federal Tax Credit	$ 13,200	$ 12,000
Non-Coincident kW AC Capacity	1.9	2.0
Annual kWh generated	4,486	2,386

Fixed Charge Rate	6.70%	6.70%
Annual Fixed Charge	884.40	804.00
Fixed Charge $/MWh	**$ 197.15**	**$ 336.97**

Compare to $23/MWh for the Max DSM programs and $40-$55/MWh for supply

* Tallahassee Case. Potential of Energy Efficiency and Renewable Energy Savings To Impact Florida's Projected Energy Use in 2014. Philip Fairey, Deputy Director. January 2006

4. Conclusion regarding the incorporation of GDS cited additional measures

ICF CONSULTING

GDS' assertion that "**<u>If ICF had included these additional energy efficiency and load management measures and program, the potential peak savings and kWh savings would be much, much greater</u>**" is not supported by the facts.

This is not to say there are not additional measures (including some on GDS' list) that would perhaps be cost-effective for GRU, and that further study of additional or substitute measures would be appropriate if GRU implements these programs. However, given the data available, the schedule, and the budget associated with this study ICF has developed a reasonable characterization of the cost and load impacts associated with DSM.

5. GDS' claim that ICF's finding that Solar Hot Water Heating is not (except in niche circumstances) cost-effective for GRU is at odds with a June 2004 Report from the Florida Solar Energy Center (FSEC) is inaccurate

ICF CONSULTING

- The cited report makes no attempt to compare the costs and load impacts of SWH with GRU's supply side and other demand side alternatives, and therefore cannot be at odds with ICF's conclusions
- Data from FSEC consistently shows that ICF's assumptions are more favorable to SWH than FSEC's
- Even using GDS' cited data from Lakeland, SWH still costs more than the supply side options at $54.59/MWh before any program marketing or administration costs are applied.

Solar Water Heater System Data	ICF	FSEC*	GDS/Lakeland**
Incremental installed cost net of federal tax credits	$ 1,720	$ 2,520	$ 2,200
kWh savings	1,466	1,994	2,700
$/MWH (excluding program costs)	$ 78.61	$ 84.67	$ 54.59

* Tallahassee Case. Potential of Energy Efficiency and Renewable Energy Savings To Impact Florida's Projected Energy Use in 2014. Philip Fairey; Deputy Director. January 2006

** As quoted by GDS. Note that several sources (see for example http://www.eere.energy.gov/state_energy_program/case_study_detail_info.cfm/cs_id=4) cite Lakeland as claiming only 1,570 kWh/year savings

6. Applicability Factors

ICF CONSULTING

GDS' declaration that ICF has "crippled" the potential for DSM by the use of "extremely low" applicability factors is incorrect

- The "Secret Surplus" report that GDS cites from California concludes that the achievable net impact from various DSM funding scenarios are*:

	GWh	%
Baseline Energy Consumption w/o DSM	324,000	
Net Energy Reduction w/Business As Usual DSM	10,000	3.1%
Advanced DSM (doubling current funding)	19,000	5.9%
Maximum DSM (quadrupling current funding)	30,000	9.3%

- ICF has not done a thorough examination of these estimates, but has no immediate grounds to think they are unreasonable for California. Note that they do not differ wildly from ICF's estimate of 8.3% for GRU

** Source: California's Secret Energy Surplus: The Potential For Energy Efficiency. FINAL REPORT. Prepared for The Energy Foundation and The Hewlett Foundation, XENERGY Inc. 2002. Page 24 and Figure 3-7*

6. Applicability Factors (continued)

ICF CONSULTING

- GDS' comparison of ICF's Applicability Factors to the Secret Surplus report is not an apples-to-apples comparison, does not represent the full breadth of the analysis, and is selective in the data it chooses to cite
  - ICF assumed that 85% of the applicable, cost-effective measures would be installed over time. The Secret Surplus methodology is not directly comparable, but essentially assumes that no more than 70% of such measures are installed.
  - GDS' quoted average applicability factor in the ICF analysis (55%) misrepresents ICF's actual assumption since many of the measures had their Applicability Factor set to zero (see page 66 of the Draft Report) in order to avoid double counting savings when two separate measures are applicable to the same end use. That is, where two measures would "compete" for applicability to replace a particular piece of equipment, ICF assumed for modeling purposes that the most cost-effective measure would win and set the Applicability Factor of the losing measure to zero. ICF assumes that the Secret Surplus report handled this problem with an adjustment elsewhere in its modeling.

6. Applicability Factors (cont.)

ICF CONSULTING

Many of the Applicability Factors cited by GDS are simply not realistic:

- Should we really expect that:
  - 100% of homes that have a second refrigerator will turn it in to GRU?
  - 100% of homes will replace their windows with ENERGY STAR windows?
  - 100% of homes will install a reflective roof coating?
  - 90% of homes will increase the level of insulation in the walls?
  - 95% of homes will install low-flow showerheads?

7. Avoided Costs

ICF CONSULTING

GDS' contention that GRU's short term avoided capacity costs are understated because DSM permits additional wholesale sales is not believed to be material

- ICF included the value from "freed up" capacity in its detailed cost effectiveness (IPM) analysis. The initial measure screening did not. However this is unlikely to have any meaningful impact on the results for two reasons:
  - It is unlikely that GRU (especially given the current pressure to cancel existing wholesale contracts) will be able to market the "DSM" power at the comparatively low (in comparison to purchased power contracts) capacities and duration necessary.
  - Since ICF passed all measures with a benefit cost ratio exceeding 0.5 to IPM for further analysis (including the potential for such wholesale credits) it is unlikely that we screened out at the initial stages anything that would have been selected by IPM.

7. Avoided Costs (continued)

GDS' assertion that since transmission and distribution avoided costs were not included in the screening then "the benefits of the maximum DSM alternative are significantly understated" is overstated

- T&D avoided costs can, in certain circumstances, be meaningful. However, such upgrades are typically a function of not only the efficiency of the customer, but also age and maintenance requirements of the existing equipment, line extensions for new subdivisions, reliability constraints, and other factors.
- T&D investment levels are often not scalable with the amount of DSM reduction (i.e., you can't buy 75% of a distribution transformer.) Although some scaling of certain components is sometimes possible, as is deferral of the investment for a period of time, the savings are not as large as one might imagine
- GRU has indicated that its current plans for T&D upgrades are insensitive the amount of DSM given the factors currently driving these upgrades
- Studies in very capacity constrained areas (such as the northeast) have found T&D avoided costs of approximately $5/MWh. Even if this were the case for GRU, it would not have a significant effect on the DSM programs found cost effective

8. Rates as DSM Options

ICF CONSULTING

- ICF did not include a comprehensive analysis of alternative rate design alternatives as a part of this study (it was not part of the scope.) However, GDS' claims that such rates are "very cost-effective" are completely unsubstantiated. In fact, GDS at no point offers any quantitative discussion of the costs and benefits of such programs on the GRU system.
- ICF believes that rate design is an important element of utility policy and management, and should be included in future efforts by GRU. However...

8. Rates as DSM Options (cont.)

ICF CONSULTING

It should be recognized that the rate design options are unlikely to have a large short-term (i.e., prior to the need for additional generation) impact on the system for several reasons:

- Interruptible and real-time pricing rates are not typically attractive to anything but large customers with flexible operations, of which GRU has very few
- The need for new generation on the GRU system is driven in large part by energy requirements, not on-peak capacity. Rate designs that simply shift usage from one period to another typically do little to defer this kind of generation requirement. GDS's statement that "even small reductions in energy usage during these peak periods could significantly delay the need for new generation capacity" is wrong and reflects a fundamental misunderstanding of why GRU needs additional generation
- Many of these rates (especially those cited by GDS including: mandatory time-use, progressive, and inverted block rates) raise very thorny issues associated with equity between customers, impact on low-income customers, impact on economic development, rate stability, and other factors. ICF anticipates that the Commission will want to move cautiously in adopting such major pricing reform

9. Relevance of the FSEC presentation to the Florida Legislature

ICF CONSULTING

- The January 2006 presentation to the Florida Legislature by the Florida Solar Energy Center (and its illustrative discussion of a potential 26% reduction if Florida were to offer additional tax credits over and above those offered by the federal government) does not support GDS' claim that ICF has understated the potential for DSM. In fact, much of the data in the report that serves as the foundation for the presentation serve to reinforce ICF's analysis or show that ICF assumed costs of DSM less than those assumed by FSEC
- The primary source of the differences is that FSEC includes PV and Solar Water Heaters, whereas ICF's analysis found them not cost-effective

Program	FSEC Assumptions		Annualized Cost (2)	Annual $/MWh Based on FSEC	ICF Assumed $/MWh
	Capital(1)	kWh Saved(3)			
Solar Water Heating	$ 2,240	1,994	$ 150.08	$ 75.27	$ 78.61 (4)
PV	$ 12,000	2,386	$ 804.00	$ 336.97	$ 197.15
Efficiency Package	$ 9,000	4,688	$ 603.00	$ 128.63	not comparable
TOTAL	$ 23,240	9,068	$ 1,557.08	$ 171.71	N/A

(1) Potential of Energy Efficiency and Renewable Energy Savings To Impact Florida's Projected Energy Use in 2014, Philip Fairey, January 2006, Table 3. Unit costs less federal tax credits

(2) Assumes a fixed charge rate of 6.7% (25 year measure life and GRU's tax exempt financing status)

(3) Ibid. Table 7a. Assumes Tallahassee weather (closest to Gainesville of cities in the study)

(4) For an apples-to-apples comparison, does not include approximately $60/year maintenance assumed by ICF, but not obviously included by FSEC

Conclusions

Summary Results

ICF CONSULTING

Criterion	Options			
	CFB	**IGCC**	**Biomass Maximum DSM**	**Maximum DSM**
Expected Revenue Requirements	Essentially Tied for Second	Best	Essentially Tied for Second	Essentially Tied for Second
Performance/Capital Cost/Financing Risk	Low	Medium High	Medium High	Medium-High
Risk Due to Exposure to High Wholesale Market Prices/High Oil and Gas Prices	Low	Low	High	Highest
Risk Due to Exposure to Low Gas Prices	Medium	Medium	Low	Low
Variability of Revenue Requirements	Low	Low	Low	Medium
Local CO_2 Emissions	High	Medium High	Low	Low
Grid CO_2 Emissions	Medium	Medium	Medium	Medium
Local NO_x, SO_2 Emissions	Low	Lower	Lower to Lowest	Lowest
Health Effects	Comply with Ambient Standards	Comply with Ambient Standards	Comply with Ambient Standards	Comply with Ambient Standards
SocioEconomic Jobs	High	High	High	Medium

Conclusions

ICF CONSULTING

- DSM is an attractive option that should be pursued regardless of the genenration choice since its costs are below generation option costs - \$23/mwh vs \$40-55/mwh. It may decrease the size of the genration addition required.
- DSM Decreases Demand up to 88 MWs by 2025, but City action to meet load growth is needed soon due to gradual ramp-up of DSM and its failure to eliminate the need for more capacity. Also, DSM requires GRU to get very good very quickly.
- All options require some new plant construction over time, and some action (peaking capacity, transmission upgrades, power purchases) required by 2011. Options without additional generation and or significant capacity imports do not exist. By 2015, current import limits will be exceeded. Imports may not be feasible and could be risky.
- Biomass capable options should be pursued in light of hedge value on CO_2 risk and to verify biomass costs and feasibility.
- Plant scalability greatest for CFB, least for IGCC, CC. Thus, a smaller CFB is an option, but a smaller IGCC is not.

Conclusions (continued)

ICF CONSULTING

- Revenue Requirements show moderate advantage for IGCC option but creates construction, financing and operations risk. If a solid fuel option is to be pursued, more than one set of quotations should be obtained for construction, operations, and financing – e.g. CFB and IGCC.
- Not having a solid fuel option exposes GRU to significant risks due to higher oil, gas and wholesale power prices, especially over time. The least generation options investment options cause the City to rely on coal power imports, and the risks that forecast coal powerplant capacity expansion elsewhere in Florida will not fully materialize.
- While these options are also susceptible to lower fuel price and CO2 risk it is unlikely that both will occur, and the effects seem less.

Conclusions (continued)

ICF CONSULTING

- Expected revenue requirement impacts are similar for the non-IGCC options and cannot be used to distinguish among the remaining options. However, in the event that rate impacts are measured, the DSM option rate impacts are larger due to lower sales demand.
- Emissions will fall from current levels regardless of options and air quality meets standards designed to protect public health with a margin. Holistic view results in minimal difference due to imports of coal power. The best situation from the perspective of emissions would be the greatest risk in terms of revenue requirements – i.e., gas powerplants dominate the grid. Residual impacts show a range.
- Biomass options create the most jobs, followed by other solid fuel options. DSM creates some jobs, but most are not local due to manufacturing elsewhere.

Attachments

ICF CONSULTING

LEDs for General Illumination

–Jeffrey Schwartz, LC, IESNA

Mr. Schwartz has over 30 years experience in the lighting industry. He serves as a lighting consultant for various ICF clients including New York State Energy Research and Development Authority (NYSERDA), the US Environmental Protection Agency (EPA), and the US Department of Energy, and Con Edison. Mr. Schwartz also serves as the Co-Chairman of the National Council on Qualifications for the Lighting Professions (NCQLP) test committee. Mr. Schwartz has written over twenty case studies on high quality energy-efficient lighting installations, and has been published in several national magazines. His previous work included sales, distribution, design, installation, and energy management for municipal, industrial, commercial, institutional, and residential clients. Over the years Mr. Schwartz has been responsible for hundreds of industrial, office, retail, commercial, and institutional lighting designs, and has trained over 1,000 lighting practitioners. Mr. Schwartz serves as a consultant for ENERGY STAR qualified residential lighting fixtures, and has been involved in writing the specifications for ENERGY STAR exit signs and ventilating fans, and he currently serves as the lighting specialist for the NYSERDA New York Energy $mart^{SM} Small Commercial Lighting Program.

Technology Status – White LEDs

ICF CONSULTING

- White LED Current Efficacy: 20 to 40 lumens per Watt range
  - The efficacy for LEDs does not include the driver, only the lamps.
    - Incandescent: 12 to 20 lumens per Watt
    - Compact Fluorescent: 50 to 60 mean lumens per Watt
    - T-8 Linear Fluorescent: 80 to 90 mean lumens per Watt
- White LED Cost (lumens per $): $20 lp/$
  - 60A Incandescent: 1441 lp/$
  - 15W Compact Fluorescent 190 lp/$

Technology Status – White LEDs

ICF CONSULTING

- White LEDs limitations and drawbacks:
  - Heat – LEDs easily break down due to heat resulting in rapid lumen depreciation and/or premature failure
  - The behavior of most conventional light sources is well understood, but the LED industry has yet to agree on a standard for measuring and publishing lumen maintenance.
  - Likewise, no agreement has been reached on how to define "life," "useful life" or "average rated life." Therefore manufacturers can claim long life without proving information on the useful life.
  - LEDs are low voltage devices that require precise current control. Actual performance is affected by improper control.

Technology Status – White LEDs

ICF CONSULTING

- White LEDs limitations and drawbacks (continued):
  - Many of the LED products being introduced today are meant to replace traditional sources without taking into account the unique optical characteristics of various LED packages, resulting in poor performance and light output.
  - Creating white LEDs is a complicated process. Simply bundling a group of LEDs into a light source can cause visible changes in the hue and striation of the light. Often there is a bluish tinge which is unacceptable for many applications
  - Color consistency and color rendering can vary between items from the same manufacturer depending on the LED bin they purchase.

Technology Status – White LEDs

ICF CONSULTING

- White LEDs – a DSM program for utilities?
  - Color consistency, efficacy, heat problems, other performance issues, and a lack of industry standards first need to be resolved by the industry.
  - White LED lighting products like MR16 and recessed cans, and flood lights are unproven in the field.
    - This creates a high risk for utilities that provide rebates for products that may fail.
      - Customer dissatisfaction
      - No long term energy savings if products fail early
  - Niche applications like task lamps and undercabinet lights may not offer guaranteed peak load savings due to limited use.

What Others Are Saying

ICF CONSULTING

Jim Broderick, Manager of the US DOE Lighting Research and Development Program

"The Energy Star program is investigating specifications for LEDs in niche applications. However, performance metrics and measurement procedures first need to be developed. Limited draft Energy Star specifications may be out later this year, but specifications would not be finalized until 2007. Again, this is for niche applications only – undercabinet, task lighting, etc."

Kevin Shaw, Lighting Design

"Product-based specification is inadequate, since the same product varies according to operating conditions." UK LED Conference, Oct. 2005

Kevin Dowling, Color Kinetics

"Binning, scaling, color temperature, calibration, specifications, and photometry" make specifying LED systems a complex exercise. LEDs Magazine, Oct. 2005

Andrew Dennington, Carlco Technical Plastics

"Customers only get 70% of the lumens out they expect, a design that only just works on paper is unlikely to work in the real world." UK LED Conference, Oct. 2005

DSM Conclusion

ICF CONSULTING

- The issues described in this presentation are being addressed by the LED and lighting industry with the help of associations, research institutes, and the Department of Energy.
- Until these issues are resolved, the risk of incorporating white LED products into demand side management programs may out weigh the advantages.