



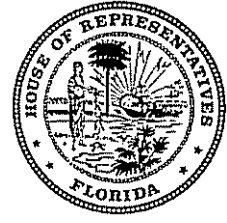
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WILL WEATHERFORD
Speaker of the House of Representatives

July 18, 2013

Ann Cole
Commission Clerk and
Administrative Services
Room 100, Easley Building
Florida Public Service Commission
2540 Shumard Oak Blvd.
Tallahassee, FL 32399-0850

Re: Docket No. 130009-EI

Dear Ms. Cole:

Enclosed for filing in the above docket is the Office of Public Counsel's Motion for Leave to File Amended Testimony. Attached to the motion is the Amended Direct Testimony and Exhibits of William R. Jacobs, Jr., Ph.D.

The original testimony was filed on June 20, 2013 pursuant to Florida Power & Light Company's (FPL) notice of intent to seek confidential status. Thereafter, FPL withdrew its notice of intent, and OPC filed the testimony and exhibits as public documents. Inasmuch as the modifications consist of redactions, the enclosed motion and attachment do not create issues of confidentiality.

July 18, 2013
Page 2

Please indicate the time and date of receipt on the enclosed duplicate of this letter and return it to our office. Thank you for your assistance.

Yours truly,

A handwritten signature in black ink that reads "Joe A. McGlothlin". The signature is written in a cursive style with a small flourish at the end.

Joseph A. McGlothlin
Associate Public Counsel

JAM:bsr

Enclosure

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Nuclear Cost Recovery
Clause

DOCKET NO.: 130009-EI
FILED: July 18, 2013

OFFICE OF PUBLIC COUNSEL'S
MOTION FOR LEAVE TO FILE AMENDED TESTIMONY

The Citizens of the State of Florida, through the Office of Public Counsel (OPC), move for leave to amend the testimony of Dr. William R. Jacobs, Jr. that OPC filed on June 20, 2013, and state:

1. On June 20, 2013, OPC filed the testimony of Dr. William R. Jacobs, Jr. In his prefiled testimony, Dr. Jacobs stated that Florida Power & Light Company (FPL) knew, or should have known, that the projection of \$688 million in Turkey Point extended power uprate (EPU) costs for calendar year 2012 that it sponsored during the September 2012 hearing was severely understated. In support of this portion of his testimony, Dr. Jacobs cited (among other things) a projected cost of \$902,911,971 for calendar year 2012 that appeared on page 4 of an internal cost review report for the Turkey Point EPU project dated August 16, 2012. Dr. Jacobs attached page 4 of the August 16, 2012 document to his testimony as Exhibit WRJ-6.

2. On July 5, 2013, FPL filed the rebuttal testimony of Terry O. Jones. In his rebuttal, Mr. Jones states that the \$902,911,971 projection for calendar year 2012 that appears on page 4 of its cost review report is an incorrect number. OPC accepts FPL's representation that the \$902,911,971 entry on its cost review report was erroneously reported by FPL.

3. In his rebuttal, Mr. Jones also testifies that FPL accelerated approximately \$47 million of vendor payments from 2013 to 2012 by August 2012. While OPC would note that Mr. Jones did not identify these accelerated payments specifically in the detailed explanation of variances from 2012 projections that is contained in his March 2012 testimony, OPC accepts FPL's representation to that effect.

4. In light of FPL's representations and clarifications, Dr. Jacobs has amended his prefiled testimony and exhibits to remove the assertion that FPL knowingly understated its projection of Turkey Point EPU costs for calendar year 2012. The deletions include Exhibits WRJ-4 through WJR-6 and references to the August 16, 2012 internal cost review document, as well as related material. The amended testimony is attached. The changes to the original testimony of June 20, 2013 consist entirely of deletions of material; no new material was added when the amended testimony was prepared.

5. The purpose of this Motion and attachment is to provide the Commission and parties with as much advance notice of this modification to testimony as possible. Through this Motion, OPC requests leave to file the amended testimony.

6. OPC has contacted the parties regarding the filing of the Motion. FPL authorized OPC to state that it does not object to this Motion. No other party responded to OPC by the time of this filing.

WHEREFORE, OPC requests leave to amend the prefiled testimony of witness Dr. William R. Jacobs, Jr.

J. R. Kelly
Public Counsel


Joseph A. McGlothlin
Associate Public Counsel

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c/o The Florida Legislature
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Attorneys for the Citizens
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CERTIFICATE OF SERVICE

Docket No. 130009-EI

I HEREBY CERTIFY that a true and correct copy of the foregoing **OFFICE OF PUBLIC COUNSEL'S MOTION FOR LEAVE TO FILE AMENDED TESTIMONY** has been furnished by electronic mail and/or U.S. Mail to the following parties on this 18th day of July, 2013.

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Joseph A. McGlothlin
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BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In Re: Nuclear Cost Recovery)
Clause.)
_____ /

Docket No. 130009-EI
ORIGINAL FILED: June 20, 2013
AMENDED FILED: July 18, 2013

AMENDED DIRECT TESTIMONY

OF

WILLIAM R. JACOBS, JR., Ph.D.

ON BEHALF OF THE CITIZENS OF

THE STATE OF FLORIDA

REVIEW OF FLORIDA POWER AND LIGHT COMPANY'S

NUCLEAR COST RECOVERY RULE FILING

1 **AMENDED DIRECT TESTIMONY**

2 **OF**

3 **WILLIAM R. JACOBS, JR., Ph.D.**

4 On Behalf of the Office of Public Counsel

5 Before the

6 Florida Public Service Commission

7 Docket No. 130009-EI

8

9 **Q. PLEASE STATE YOUR NAME, TITLE AND BUSINESS ADDRESS.**

10 A. My name is William R. Jacobs, Jr., Ph.D. I am an Executive Consultant with GDS
11 Associates, Inc. ("GDS"). My business address is 1850 Parkway Place, Suite 800,
12 Marietta, Georgia 30067.

13

14 **Q. DR. JACOBS, PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND**
15 **AND EXPERIENCE.**

16 A. I received a Bachelor of Mechanical Engineering in 1968, a Master of Science in Nuclear
17 Engineering in 1969 and a Ph.D. in Nuclear Engineering in 1971, all from the Georgia
18 Institute of Technology. I am a registered professional engineer and a member of the
19 American Nuclear Society. I have more than 30 years of experience in the electric power
20 industry including more than 12 years of power plant construction and start-up
21 experience. I have participated in the construction and start-up of seven power plants in
22 this country and overseas in management positions including start-up manager and site
23 manager. As a loaned employee at the Institute of Nuclear Power Operations ("INPO"), I

1 participated in the Construction Project Evaluation Program, performed operating plant
2 evaluations and assisted in the development of the Outage Management Evaluation
3 Program. Since joining GDS in 1986, I have participated in rate case and litigation
4 support activities related to power plant construction, operation and decommissioning. I
5 have evaluated nuclear power plant outages at numerous nuclear plants throughout the
6 United States. I served on the management committee of Plum Point Unit 1, a 650 MWe
7 coal fired power plant located near Osceola, Arkansas. As a member of the management
8 committee, I assisted in providing oversight of the EPC contractor for this project. I am
9 currently the Georgia Public Service Commission's ("GPSC") Independent Construction
10 Monitor for Georgia Power Vogtle 3 and 4 nuclear project. As the Independent
11 Construction Monitor, I assist the GPSC Commissioners and Staff in providing
12 regulatory oversight of the project. My monitoring activities include regular meetings
13 with project management personnel and regular visits to the Vogtle plant site to monitor
14 construction activities and assess the project schedule and budget. My résumé is included
15 as Exhibit WRJ-1.

16
17 **Q. WERE YOU ASSISTED BY OTHER GDS PERSONNEL IN THIS EFFORT?**

18 A. Yes, I was assisted by Mr. James P. McGaughy, Jr., a former nuclear utility executive
19 with over 40 years of experience. Mr. McGaughy's résumé is attached to this testimony
20 as Exhibit WRJ-2. I have reviewed the work of Mr. McGaughy, and have incorporated
21 and adopted it as my own in this testimony.

1 **Q. WHAT IS THE NATURE OF YOUR BUSINESS?**

2 A. GDS is an engineering and consulting firm with offices in Marietta, Georgia; Austin,
3 Texas; Manchester, New Hampshire; Madison, Wisconsin; and Auburn, Alabama. GDS
4 provides a variety of services to the electric utility industry, including power supply
5 planning, generation support services, rates and regulatory consulting, financial analysis,
6 load forecasting and statistical services. Generation support services provided by GDS
7 include fossil and nuclear plant monitoring, plant ownership feasibility studies, plant
8 management audits, production cost modeling and expert testimony on matters relating to
9 plant management, construction, licensing and performance issues in technical litigation
10 and regulatory proceedings.

11

12 **Q. WHOM ARE YOU REPRESENTING IN THIS PROCEEDING?**

13 A. I am appearing on behalf of the Florida Office of Public Counsel (“OPC”), who
14 represents the ratepayers of Florida Power & Light Company (“FPL”).

15

16 **Q. WHAT WAS YOUR ASSIGNMENT IN THIS PROCEEDING?**

17 A. I was asked to assist OPC in conducting a review and evaluation of requests by FPL for
18 authority to collect historical and projected costs associated with extended power uprate
19 (“EPU”) projects being pursued at the Turkey Point Units 3&4 and at the St. Lucie Units
20 1&2 nuclear plants, and historical and projected costs associated with FPL’s Turkey
21 Point Units 6&7 new nuclear project through the capacity cost recovery clause. In light
22 of the progress made on these projects and the availability of new information, I was

1 asked to present my findings to assist the Florida Public Service Commission (“FPSC” or
2 “Commission”) in making its determination regarding FPL’s requests.

3
4 **Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THIS COMMISSION?**

5 A. Yes. I testified on behalf of OPC in the previous nuclear cost recovery clause (“NCRC”)
6 proceedings in Docket Nos. 080009-EI, 090009-EI, 100009-EI, 110009-EI, and 120009-
7 EI.

8
9 **Q. PLEASE PROVIDE A BRIEF OVERVIEW OF THE NATURE AND STATUS OF**
10 **FPL’S NUCLEAR PROJECTS.**

11 A. FPL currently has two categories of major nuclear projects — “uprates” and proposed
12 new nuclear units — underway. The most active projects at this time are the projects to
13 increase the existing generating capacities of Turkey Point Units 3&4 and St. Lucie Units
14 1&2 by a total of 512 MWe. FPL refers to these activities at existing Turkey Point and
15 St. Lucie nuclear units as the “extended power uprate” or the “EPU project.” According
16 to FPL, the EPU projects are essentially complete, with each unit now operating to
17 achieve a total of 512 additional MWe. As of December 31, 2012, FPL had spent
18 approximately \$3.1 billion on the EPU projects and had estimated that the final cost of
19 these projects, including transmission and AFUDC, would total \$3.4 billion when
20 completed in 2013. Of this total amount, approximately \$2.2 billion is attributable to the
21 Turkey Point EPU project and the remaining \$1.2 billion to the St. Lucie EPU project.
22 On a dollar-per-kilowatt (\$/kW) basis, this results in approximately \$9,500/kW for
23 Turkey Point and approximately \$4,300/kW for St. Lucie. When only construction costs

1 are included, the Turkey Point and St. Lucie EPU values are \$8,100/kW and \$3,800/kW,
2 respectively. In 2007, FPL estimated that the Turkey Point EPU project would cost only
3 10% more than the St. Lucie EPU on a \$/kW basis. However, based on current
4 information, the Turkey Point EPU project now costs nearly TWICE the cost of the St.
5 Lucie EPU project on a \$/kW basis.

6 The other active project is the development of Turkey Point Units 6&7, a new
7 nuclear plant consisting of two Westinghouse AP1000 reactors. This project is in the
8 development stage. FPL projects that this plant will provide 2,200 megawatts (MWe) of
9 capacity with on-line dates of 2022 and 2023.

10
11 **Q. PLEASE SUMMARIZE OPC'S PAST PARTICIPATION IN THE**
12 **PROCEEDINGS ON FPL'S NUCLEAR PROJECTS.**

13 A. I will begin with the proposed new Turkey Point Units 6&7. I am informed that OPC's
14 earliest involvement was when OPC objected to FPL's request for a declaratory statement
15 concerning the classification of expenses that FPL was to incur prior to the date that site
16 selection expenses were completed. FPL asked the Commission to confirm that such
17 items would be treated as pre-construction expenses, and thus would qualify for recovery
18 through the NCRC. Because FPL's examples included expensive, "long lead"
19 equipment, OPC asked for a hearing on FPL's petition to develop its impact on
20 customers' bills. The Commission denied OPC's request for a hearing and granted FPL's
21 petition.

22 In Docket No. 080009-EI, I criticized FPL's initial policy of contracting for the
23 development of Turkey Point Units 6&7 on the basis of separate contracts rather than an

1 overall EPC contract. More recently, because I believe that the minimalist approach that
2 FPL is taking with respect to the development of its proposed new nuclear units in light
3 of the downward trend in gas prices and uncertainty regarding future load growth is a
4 preferable course of action, OPC has not taken exception to FPL's pursuit of licensing or
5 the costs related to that effort.

6
7 **Q. WHAT ABOUT FPL'S EPU ACTIVITIES AT THE TURKEY POINT AND ST.
8 LUCIE UNITS?**

9 A. OPC frequently has opposed aspects of FPL's EPU activities. In Docket No. 080009-EI,
10 I testified that FPL's support for entering numerous "sole source" and "single source
11 contracts" rather than seeking competitive bids was inadequate. I recommended that the
12 Commission disallow the return on equity portion of the largest such unjustified contract,
13 or, at a minimum, direct FPL to improve its procedures for determining when a departure
14 from competitive bidding was acceptable. The Commission declined to adopt my
15 recommendations.

16 In Docket No. 090009-EI, I criticized the absence of a rigorous methodology for
17 ensuring that only costs that are incremental in nature and attributable only to FPL's EPU
18 activities are collected through the clause. I proposed a discrete "separate and apart"
19 analytical methodology, which FPL opposed on the grounds that the different review it
20 had in place was sufficient for the purpose. Ultimately, the Commission rejected my
21 recommended methodology and accepted FPL's presentation.

22 In Docket No. 100009-EI, during which FPL reported that its total estimated EPU
23 costs had increased by \$500 million over the prior year, I challenged FPL's methodology

1 for gauging the economic feasibility of its uprates, which involved excluding past
2 expenditures from the study. I cautioned that this methodology is not well suited to a
3 situation in which projected completion costs are increasing significantly. I also
4 recommended that the Commission direct FPL to develop a risk-sharing mechanism so
5 that it would have “skin in the game.” However, the Commission ruled that it had no
6 authority to impose a risk-sharing mechanism.

7 In Docket 110009-EI (which included issues from the prior year that had been
8 carried over by stipulation), I testified that FPL failed to present the Commission with the
9 most current construction cost estimate that it projected for its EPU project during the
10 September 2009 hearing. Based on my testimony, OPC recommended in its brief that the
11 Commission conclude that FPL had violated the rule governing the nuclear cost recovery
12 proceedings, and that it impose a fine on FPL at or near the maximum amount of
13 \$1,180,000. The Commission voted to deny OPC’s recommendation.

14 In Docket No. 110009-EI, I also testified that it was imprudent for FPL to “fast
15 track” the construction of the uprates when FPL had not begun detailed design work, and
16 thus had no adequate grasp of either the scope or the cost of the project. As a decision on
17 the matter had been “carried over,” I also reiterated my criticism of the application of
18 FPL’s methodology for measuring economic feasibility of the EPU project, and
19 recommended that the Commission require FPL to perform a “breakeven analysis” for
20 the uprates similar to the breakeven analysis that FPL proposed, and the Commission
21 endorsed, for FPL’s proposed new nuclear units. In order to ensure that one less-than-
22 cost-effective project was not being subsidized by the other, I recommended that the
23 Commission require FPL to prepare separate breakeven analyses for the St. Lucie and

1 Turkey Point plants. The Commission rejected OPC's positions and ruled in favor of
2 FPL.

3 In Docket No. 120009-EI, my colleague Brian Smith and I addressed the \$682
4 million year-over-year increase in FPL's estimate of the total cost of the EPU projects to
5 which FPL witness Terry Jones testified in August 2012. We pointed out that \$555
6 million, or 81% of this projected amount, was attributable to the soaring costs of the
7 Turkey Point EPU activities. I testified that the cost of the Turkey Point uprate capacity
8 had become more expensive than the corresponding cost of a new nuclear unit, as
9 measured by FPL's estimate of the cost of its proposed Turkey Point Units 6&7,
10 expressed in 2012 dollars. Mr. Smith sponsored an exhibit demonstrating that the Turkey
11 Point EPU project was already on course to be non-cost-effective under assumptions that
12 were extremely favorable to FPL. Based on this information, I recommended that the
13 Commission limit the total cost of the EPU project that FPL could recover from
14 customers to the revised estimate of \$1.6 billion of construction costs that FPL's
15 witnesses sponsored in the docket. (I note that in his rebuttal testimony, FPL witness
16 Jones said that the total cost to complete the Turkey Point EPU project was \$1.673
17 billion.) Ultimately, the Commission accepted FPL's presentation, and did not adopt my
18 recommendation.

19
20 **Q. PLEASE SUMMARIZE FPL'S REQUEST FOR COST RECOVERY IN THIS**
21 **DOCKET UNDER THE NUCLEAR COST RECOVERY CLAUSE.**

22 **A.** With respect to Turkey Point Units 6&7, FPL has continued to limit its activities to those
23 necessary to pursue an operating license. At this time, I am not recommending any

1 adjustments to the amounts that FPL wishes to recover from customers to sustain its
2 conservative approach.

3 With respect to the now-completed EPU activities, FPL has increased its
4 estimated cost of completion from \$3.1 billion to \$3.4 billion. Essentially, this entire
5 amount is attributable to the Turkey Point EPU project. More critically, the revised
6 “nonbinding estimate” for the Turkey Point EPU project is now approaching \$2.2 billion,
7 or nearly three times the amount of the original \$750 million estimate submitted by FPL
8 in its 2007 Need Determination proceeding.

9
10 **Q. ON WHAT DO YOU BASE YOUR \$2.2 BILLION FIGURE?**

11 A. I used the Turkey Point EPU cash flow summaries (through 2012) provided by FPL in a
12 late-filed exhibit to witness Jones’ deposition taken on June 17, 2013. [Exhibit WRJ-3] I
13 added all items designated as specific to Turkey Point. Then, I added the Carrying
14 Charges on Construction, Non-Incremental Capital, and Carrying Charges DTA/(DTL)
15 and multiplied that sum by the ratio of Turkey Point EPU Incremental Capital to the sum
16 of Turkey Point EPU and St. Lucie EPU Incremental Capital. I assumed that these
17 charges are roughly proportional to the Capital Charges. To determine the 2013 charges
18 to Turkey Point, I used the \$280 million EPU completion amount from TOJ-13, TOR-2.
19 Finally, I multiplied that amount by the ratio of 2013 capital charges for Turkey Point
20 (\$227 million) to the combined 2013 capital charges for Turkey Point and St. Lucie
21 (\$243 million). I did not include any allocation of Participation on Incremental Capital,
22 as this item only applied to the St. Lucie EPU project.

1 **Q. PLEASE SUMMARIZE YOUR ASSESSMENT OF THE INFORMATION THAT**
2 **FPL HAS PRESENTED IN SUPPORT OF ITS PENDING REQUEST.**

3 A. The fundamental differences between the design/configuration of the St. Lucie plant site
4 and that of the Turkey Point plant site that FPL witness Jones and I described in earlier
5 testimony continue to result in vastly different outcomes for the respective EPU project
6 activities and, unhappily, for FPL's customers.

7
8 **Q. PLEASE ELABORATE, BEGINNING WITH THE ST. LUCIE EPU ACTIVITIES.**

9 A. In this proceeding, the FPL witnesses testify that the St. Lucie uprates, which are now in
10 service, have added 280 MWe of capacity. At a cost of \$1.2 billion, this computes to
11 \$4,300/kW. As I will discuss further below, it appears that the St. Lucie EPU will
12 provide capacity at a cost that is economically justifiable and beneficial to customers.

13

14 **Q. WHAT ABOUT THE TURKEY POINT EPU ACTIVITIES?**

15 A. The Turkey Point EPU is an entirely different story. One year ago, Mr. Smith and I
16 testified that, at the cost levels projected by FPL at the time, Turkey Point was "under
17 water" — or exorbitantly expensive to the point that, considering the future construction
18 and related costs alone (in other words, consistent with *FPL's* preferred feasibility
19 methodology), costs would exceed benefits to customers. After August 2012, FPL
20 engaged in an expensive frenzy of spending to complete the Turkey Point EPU project.
21 Now that the full cost of the Turkey Point EPU project is finally coming into focus, the
22 magnitude of the harm to ratepayers can be comprehended.

1 **Q. HOW MUCH DID FPL SPEND IN 2012 AND 2013 TO COMPLETE THE**
2 **TURKEY POINT EPU PROJECT?**

3 A. In prefiled testimony dated April 2012, FPL witness Jones stated that the construction
4 costs associated with the Turkey Point EPU in 2012 would amount to \$688 million. As it
5 turned out, FPL spent \$975 million on the Turkey Point EPU in calendar year 2012 alone,
6 and FPL now projects that it will spend another \$280 million (including AFUDC) in 2013
7 to complete the EPU project. I note that the new estimate of 2013 EPU construction
8 costs is \$50 million higher than the amount that Mr. Jones predicted for 2013 just last
9 year. Fortunately, the Turkey Point EPU work has been completed, so this should be the
10 last year of such outsized deliveries of bad news.

11
12 **Q. EARLIER YOU SAID THAT IT APPEARS THE ST. LUCIE EPU ACTIVITIES**
13 **HAVE BEEN COMPLETED AT A COST THAT IS ECONOMIC FOR**
14 **RATEPAYERS. BASED ON THE ADDITIONAL COSTS THAT FPL**
15 **INCURRED IN 2012 AND THAT YOU DESCRIBED ABOVE FOR 2013, IS THIS**
16 **TRUE OF THE TURKEY POINT EPU ACTIVITIES?**

17 A. No. To the contrary, the extremely expensive cost of the Turkey Point EPU capacity will
18 be uneconomic to ratepayers. Therefore, I recommend that the Commission act to
19 disallow some of these excessive and unreasonable costs. In my testimony below, I will
20 identify the basis for such an adjustment.

1 **Q. PLEASE CONTINUE.**

2 A. The original estimate of the Turkey Point EPU project was \$750 million. The current
3 estimate is \$2.2 billion. In his feasibility analyses, FPL witness Dr. Steven Sim never
4 presented the feasibility of the Turkey Point EPU project on a standalone basis. Thus,
5 FPL's methodology diluted the extremely high costs of the Turkey Point uprate activities
6 with those of the more economically sound St. Lucie project activities. The Commission
7 made clear in Order No. PSC-09-0783-FOF-EI that it has the discretion to determine
8 whether a methodology for assessing economic feasibility that it approved for a project in
9 the past continues to be appropriate for that project. That should hold true for the manner
10 of measuring the economics of the project and the reasonableness of the final increment
11 of costs, as well. More than ever, a separate appraisal of the economics of the Turkey
12 Point EPU activities is needed now to illuminate the situation from the ratepayers'
13 perspective.

14
15 **Q. DOES FPL WITNESS DR. SIM'S 2013 TESTIMONY GIVE SUPPORT TO
16 TURKEY POINT'S ECONOMIC BENEFITS TO CUSTOMERS?**

17 A. No. If, as Dr. Sim contends, his breakeven calculation quantifies the maximum installed
18 cost of new nuclear capacity that is cost-effective, then it follows that Turkey Point
19 uprate capacity must cost less than the breakeven value to be cost-effective. This is true
20 because the economics of a nuclear plant are driven by the amount of fuel savings over
21 time necessary to overcome the high initial capital cost. The breakeven value of a new
22 nuclear unit is based on an expectation that the new unit will generate fuel savings for at
23 least 40 years. The Turkey Point EPU project has only 19 years remaining on already

1 extended licenses. Accordingly, Dr. Sim's breakeven value is a very conservative choice
2 as the test for the economics of the Turkey Point EPU project.

3
4 **Q. PLEASE DESCRIBE HOW YOU COMPARED THE TURKEY POINT EPU**
5 **CAPACITY TO THE COST OF THE PROPOSED TURKEY POINT UNITS 6&7**
6 **FOR THIS PROCEEDING ON A COMPARABLE, APPLES-TO-APPLES BASIS.**

7 A. I performed this comparison by utilizing Dr. Sim's May 2013 testimony. He determined
8 the "breakeven costs" for new nuclear capacity for a number of cases.

9
10 **Q. WHAT IS A BREAKEVEN ANALYSIS, AND WHY IS IT AN APPROPRIATE**
11 **METHODOLOGY FOR THE COMMISSION TO USE IN THIS PROCEEDING**
12 **TO ASSESS THE ECONOMICS OF THE TURKEY POINT EPU PROJECT?**

13 A. A breakeven analysis calculates the maximum capital investment that can be made in
14 additional nuclear capacity to remain cost-effective relative to the utility's alternative.
15 Dr. Sim calculates the Cumulative Present Value Revenue Requirements (CPVRR) for
16 alternative generation capacity scenarios with variable assumptions concerning fossil fuel
17 prices and environmental costs. For each scenario, he then determines the capital cost in
18 2013 dollars for a nuclear plant on a \$/kW basis to provide the same overall costs to
19 ratepayers over the long term as the fossil fuel alternative generation. This is what he
20 calls the nuclear "breakeven cost." If this "breakeven cost" exceeds his estimate of the
21 2013 "overnight cost" for a new nuclear plant, then the nuclear option would be
22 economic. However, if the "overnight cost" is higher than the "breakeven cost," then the
23 nuclear project is not cost-effective. Note that, because the analysis compares the full

1 cost of the nuclear option to the full costs of FPL's gas-fired alternative, the breakeven
2 calculation takes into account the fuel savings associated with nuclear generating
3 capacity. In other words, if the nuclear option exceeds the breakeven cost, it is not cost-
4 effective, despite the fuel savings to which FPL points as one of the chief benefits of the
5 uprate.

6
7 **Q. WHAT ARE "OVERNIGHT COSTS"?**

8 A. The term "overnight costs" refers to the costs that are associated with the assumption that
9 a project is constructed immediately, in the present. Overnight costs eliminate carrying
10 costs and the effect of inflation over time. They are expressed in current dollars.
11 Accordingly, overnight costs are expressed in the same "units" as the cost of a project
12 entering service now — except that, to the extent that the project actually entering service
13 includes historical costs incurred during the period 2008-2013, the actual project costs
14 understate what they would be if expressed in 2013 dollars. For that reason, the use of
15 overnight costs is a conservative way of comparing the EPU costs to the capacity costs of
16 Turkey Point Units 6&7.

17
18 **Q. DIDN'T FPL WITNESS DR. SIM DISPUTE YOUR USE OF OVERNIGHT**
19 **COSTS IN A COMPARISON ONE YEAR AGO?**

20 A. Yes. Dr. Sim asserted that the cost of EPU capacity completed at the present time should
21 be compared to the cost of the Turkey Point Units 6&7 expressed in dollars that have
22 been inflated over a period of some 10 years. His assertion had no value, other than the
23 fact that it was one way of trying to avoid the obvious conclusion that the Turkey Point

1 EPU capacity was already more expensive than the corresponding cost of new nuclear
2 capacity one year ago.

3

4 **Q. PLEASE CONTINUE.**

5 A. When evaluating the economics of the EPU project, it is conservative (i.e., more
6 favorable to the EPU project) to consider the EPU construction costs as overnight costs to
7 be compared with Dr. Sim's breakeven costs.

8

9 **Q. WHY IS THIS THE CASE?**

10 A. The cost of the EPU capacity, which was completed in early 2013, is expressed in current
11 2013 dollars. Dr. Sim's "breakeven costs" are also expressed in 2013 dollars, so the
12 numbers are "apples-to apples." Given that a significant portion of the EPU dollars were
13 spent prior to 2013 and are thus subject to less inflation, the actual EPU dollars would be
14 somewhat understated in terms of 2013 dollars, therefore making the 2013 EPU dollar
15 cost look more favorable when compared to Dr. Sim's 2013 overnight costs.

16

17 **Q. PLEASE ADDRESS THE BREAKEVEN CALCULATION APPLICABLE TO**
18 **THE ST. LUCIE UPRATE.**

19 A. Looking at plant construction costs alone, the St. Lucie EPU project comes in at
20 \$3,800/kW and the corresponding value for the Turkey Point EPU is \$8,100/kW. Dr.
21 Sim's breakeven costs for new nuclear construction are in a range of \$4,217/kW to
22 \$6,640/kW. [Exhibit SRS-8 of witness Dr. Sim's 2013 testimony] The St. Lucie EPU

1 project, at \$3,800/kW is well below all the breakeven cost scenarios and thus, using Dr.
2 Sim's logic, is economic.

3
4 **Q. TURNING TO THE TURKEY POINT EPU PROJECT, WHAT WAS THE**
5 **CORRESPONDING COMPARISON FROM ONE YEAR AGO?**

6 A In his 2012 testimony, Dr. Sim's breakeven costs (expressed in overnight dollars) ranged
7 from \$4,202 to \$6,326/kW, while the Turkey Point EPU project was predicted to come in
8 at \$6,700/kW (in 2013 dollars).

9
10 **Q. WHAT IS THE APPROPRIATE BREAKEVEN COMPARISON FOR THE**
11 **TURKEY POINT EPU PROJECT AT THIS TIME?**

12 A. As I stated, in his current testimony Dr. Sim's breakeven costs range from \$4,217 to
13 \$6,640/kW. Turkey Point's EPU project costs have increased to \$8,100/kW. Further, as
14 I explained earlier, the range of \$4,217 to \$6,640 is the cost of capacity that will be
15 expected to remain in service (and reducing fuel costs compared to the alternative) for a
16 minimum of 40 years. By contrast, the uprate has an expected life of only 19 years
17 before the already extended operating licenses expire. For this reason, using even the
18 "breakeven cost" of Turkey Point Units 6&7 as the maximum cost-effective level for
19 uprate capacity is conservative. Because the uprate has a shorter life span in which to use
20 lower fuel costs to overcome the capital cost burden of nuclear capacity, the "breakeven
21 cost" of the uprate would be lower than that of a new unit.

1 **Q. WHAT BEARING DOES THIS INFORMATION HAVE ON THE ECONOMICS**
2 **OF TURKEY POINT EPU CAPACITY?**

3 A. The Turkey Point EPU, at \$8,100/kW, is clearly uneconomic for FPL's customers. The
4 cost of the Turkey Point EPU capacity exceeds \$6,640/kW (the upper end of Dr. Sim's
5 breakeven values for new nuclear capacity, and therefore the most conservative and
6 favorable value to FPL) by \$1,460/kW. There are 232,000 kW of Turkey Point EPU
7 capacity. This means that, under the breakeven standard, the Turkey Point EPU
8 investment exceeds the maximum cost-effective level for new nuclear capacity by
9 \$338,720,000. Note that this differential is conservative, in that the cost of Turkey Point
10 EPU capacity would need to be less than the cost for new nuclear capacity in view of its
11 shorter operating life, as explained above.

12
13 **Q. EARLIER, YOU ALLUDED TO DR. SIM'S USE OF 2013 DOLLARS AND 2022-**
14 **2023 DOLLARS IN THE SAME COMPARISON. CAN FPL JUSTIFY THE COST**
15 **OF THE TURKEY POINT EPU PROJECT USING THAT YARDSTICK IN THIS**
16 **HEARING CYCLE, WHICH INVOLVES EPU PROJECT COMPLETION AND**
17 **CLOSE-OUT COSTS?**

18 A. No.

19

20 **Q. PLEASE EXPLAIN.**

21 A. At the time of Dr. Sim's testimony in 2012, he claimed that the Turkey Point EPU project
22 costs were less than the costs for Turkey Point Units 6&7; however, he used 2022 and
23 2023 dollars for Units 6&7 in his comparison. I addressed the shortcoming of this

1 comparison earlier. Even using Dr. Sim's seriously flawed methodology, the claim that
2 the Turkey Point EPU project is less expensive than Turkey Point Units 6&7 is no longer
3 the case. FPL's upper range for Turkey Point Units 6&7 (\$18.5 billion for 2,200 MWe,
4 including transmission and financing costs) is \$8,400/kW in 2022 dollars, while the
5 Turkey Point EPU project is coming in at about \$9,500/kW (\$2.2 billion for 232 MWe,
6 including transmission and financing costs) in 2013 dollars.

7
8 **Q. ARE THERE ANY MORE CONSIDERATIONS THAT YOU BELIEVE SHOULD**
9 **WEIGH ON THE COMMISSION'S DECISION ON FPL'S REQUEST TO**
10 **RECOVER COSTS FROM ITS CUSTOMERS?**

11 A. Yes. The Commission will recall that FPL witness Jones contended in 2011 that FPL's
12 \$2.48 billion projection for the cost of both EPU projects was "highly informed," only to
13 testify later that the following year's projection exceeded this estimate by \$682 million.
14 In April 2012, FPL witness Jones projected that FPL would spend \$688 million on the
15 Turkey Point EPU activity in 2012. As it turned out, FPL spent \$975 million on Turkey
16 Point during calendar year 2012. FPL's response to OPC's Second Set of Interrogatories,
17 Interrogatory Number 3 in this docket establishes that, as of the end of August 2012, FPL
18 had already spent \$670 million of the \$688 million that FPL projected in its April 2012
19 filing for all of 2012. Sometimes the impact of an imprudent decision does not show up
20 in the form of unreasonable (and even inordinate) costs until subsequent periods. I
21 believe that is the case with FPL's decision to undertake the Turkey Point EPU project in
22 the face of the levels of complexity and uncertainty of which FPL was aware at the

1 outset, and to continue the project without developing an adequate provision for
2 contingency when the costs began to soar.

3
4 **Q. DOESN'T FPL WITNESS JONES EXPLAIN THE CAUSES AND SOURCES OF**
5 **THE HIGH COSTS THAT FPL INCURRED DURING 2012 IN THE**
6 **TESTIMONY THAT HE FILED IN MARCH 2013?**

7 A. Mr. Jones identifies the items on which FPL spent money. However, under the
8 circumstances of the Turkey Point EPU project, describing the items on which money
9 was spent in 2012 does not establish the reasonableness of the expenditures. Further, in
10 his March testimony, Mr. Jones does not justify the discrepancy between the amount to
11 which he testified and the level of expenditures that FPL actually incurred.

12
13 **Q. PLEASE EXPLAIN YOUR ANSWER.**

14 A. First of all, as the Commission is aware, Mr. Jones has demonstrated in past testimony
15 that he is (and has been) keenly aware of the differences in design configuration between
16 the St. Lucie and the Turkey Point Units. The problem is that he uses the differences and
17 the resulting complications as after-the-fact justifications, when instead these illustrate
18 the imprudence of failing to either accomplish advanced engineering at the outset of these
19 projects or to incorporate a contingency that is commensurate with the enormity of the
20 risk involved.

1 **Q. PLEASE CONTINUE.**

2 A. In 2012, I recommended that the Commission protect customers from a portion of the
3 excessive costs of the Turkey Point EPU project. Had FPL's projection of 2012 costs and
4 total costs for this project at the time been more realistic, the magnitude of the extent to
5 which the Turkey Point EPU project is uneconomic for customers would have been
6 apparent sooner. (The actual expenditures for calendar year 2012 exceeded FPL's April
7 2012 estimate of \$688 million by \$287 million.) Had the FPSC known this information
8 one year ago, it may have decided the issue of disallowance that OPC raised at that time
9 differently.

10

11 **Q. WHAT DO YOU RECOMMEND?**

12 A. Given the large, unrevealed increase in 2012 costs of the Turkey Point EPU project, I
13 recommend that the Commission disallow \$200 million.

14

15 **Q. ON WHAT DO YOU BASE YOUR RECOMMENDATION OF A**
16 **DISALLOWANCE?**

17 A. If the need for an alternative method of measuring the impact of the economics of the
18 Turkey Point EPU project on customers was not apparent before, it should have been
19 apparent in 2012, when FPL had likely spent the entire amount that it forecasted for that
20 year by the end of August 2012. As I stated, in 2012 the Turkey Point EPU project
21 would have been recognized as uneconomic, based even on Dr. Sim's flawed insistence
22 on ignoring sunk costs. Had FPL provided realistic figures in 2012, the extent of the
23 disparity that the analysis disclosed would have been substantially greater. Viewing the

1 economics of the project with the benefit of near-final cost information reveals the extent
2 to which the cost — particularly 2012 costs — reached unreasonable levels.

3
4 **Q. IS YOUR RECOMMENDATION BASED ON HINDSIGHT?**

5 A. No, it is not. As I have addressed in testimony in prior years, on a stand-alone basis the
6 Turkey Point EPU project is clearly uneconomic and harmful to FPL customers. Absent
7 FPL's presentation of a gross under-estimation of the EPU project final cost, the
8 Commission may have accepted my earlier recommendations to protect FPL's customers.
9 My testimony in prior NCRC dockets, in which I warned the Commission of continued
10 cost overruns and that the Turkey Point EPU project would be uneconomic when
11 completed, clearly demonstrates that this recommendation is not based on hindsight.
12 Further, the recommended disallowance of \$200 million relates to 2012 expenditures,
13 over which the Commission still has jurisdiction, as I have been informed by OPC. The
14 amount is less than the \$338,720,000 by which the Turkey Point EPU exceeds the
15 breakeven standard for a new nuclear project (measured on a basis highly favorable to
16 FPL) by \$138,720,000. The disallowance, then, provides only partial protection to the
17 ratepayers.

18
19 **Q. DO YOU HAVE ANY FURTHER COMMENTS ON THE FPL "EPU
20 EXPERIENCE"?**

21 A. I believe that the overall experience is a "cautionary tale" with respect to any future
22 projects that are analogous to the Turkey Point EPU project. To avoid a case of runaway
23 spending resulting in a project that is harmful to ratepayers, it is clear that a utility

1 contemplating a project having the magnitude and complexity of the Turkey Point EPU
2 project must either perform a level of engineering sufficient to provide a grasp on overall
3 costs, or must incorporate a level of contingency adequate to reflect the uncertainty of not
4 having performed the engineering at the outset. Similarly, for a multi-year project of vast
5 complexity and uncertainty that is being “fast-tracked,” the “sunk cost exclusion” form of
6 feasibility study may not be sufficient, in and of itself, to identify a project that is
7 spiraling out of control. Lastly, a feasibility study that combines plant sites that are
8 geographically separate and that present very different challenges from an engineering
9 and construction standpoint can result in a strong project obscuring the deficiencies of a
10 weak one.

11
12 **Q. ARE YOU ALONE IN YOUR CHARACTERIZATION OF THE RISK OF USING**
13 **FPL’S FEASIBILITY METHODOLOGY FOR A PROJECT THAT INVOLVES**
14 **SUBSTANTIAL UNCERTAINTY?**

15 A. No. Other cost managers have made similar observations. They have coined the term
16 “sunk cost dilemma” for the phenomenon of a series of decisions that appear to be
17 appropriate when sunk costs are excluded, but which lead — due to changes in the
18 assumptions that drive each of a series of decision points — to a non-economic result.
19 To avoid such a result, some authors recommend such steps as:

- 20 • Ask hard questions early;
- 21 • Iterate rapidly and inexpensively;
- 22 • After repeatedly missing forecasts, managers should be that much more
23 diligent about ensuring that future estimates are realistic; and

- 1 • Avoid getting caught in the trap of repeatedly believing questionable
2 estimates, when past evidence suggests that they are unreliable.

3 I have attached as Exhibit WRJ-7 a monograph by Charles Conway that is one of
4 several examples of articles on the subject of which I have become aware. I believe that
5 the steps recommended in this and other similar articles are consistent with the
6 recommendations regarding the need for advanced engineering and an adequate provision
7 for contingency that I made in earlier testimony.

8
9 **Q. IN MAY 2013, FPL WITNESS JONES TESTIFIED THAT THE BENEFITS OF**
10 **THE EPU PROJECT WOULD NOT HAVE BEEN POSSIBLE IF THE**
11 **LEGISLATURE HAD NOT ENACTED THE NUCLEAR COST RECOVERY**
12 **LAW AND RULE. HOW DO YOU RESPOND?**

13 A. I suspect it is likely that FPL would have been unwilling to undertake the EPU project in
14 the absence of a vehicle such as the NCRC; however I regard that likelihood as a function
15 of the risk that arises from the uncertainty associated with proceeding in the absence of
16 up-front engineering and an unwillingness to incorporate adequate contingency.

17
18 **Q. PLEASE SUMMARIZE YOUR TESTIMONY AND RECOMMENDATION.**

19 A. Year after year, FPL has underestimated the cost of the Turkey Point EPU project to the
20 point that the project costs will ultimately exceed the original estimate by more than \$1.4
21 billion and this will be unreasonable and uneconomic to FPL's ratepayers. The costs
22 resulting from this pattern of year after year cost increases should not fall solely on the
23 ratepayers. The Commission can and should apply the breakeven standard to gauge the

1 magnitude of excessive Turkey Point EPU project costs in order to protect ratepayers
2 from the 2012 surge in unreasonable costs. While the dollar amount in my
3 recommendation falls short of disallowing the full extent of the uneconomic costs of the
4 Turkey Point EPU project, it does protect FPL customers from the 2012 surge in costs.

5

6 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

7 A. Yes, it does.

William R. Jacobs, Jr.
Executive Consultant

EDUCATION: Ph.D., Nuclear Engineering, Georgia Tech 1971
MS, Nuclear Engineering, Georgia Tech 1969
BS, Mechanical Engineering, Georgia Tech 1968

ENGINEERING REGISTRATION: Registered Professional Engineer

PROFESSIONAL MEMBERSHIP: American Nuclear Society

EXPERIENCE:

Dr. Jacobs has over thirty-five years of experience in a wide range of activities in the electric power generation industry. He has extensive experience in the construction, startup and operation of nuclear power plants. While at the Institute of Nuclear Power Operation (INPO), Dr. Jacobs assisted in development of INPO's outage management evaluation group. He has provided expert testimony related to nuclear plant operation and outages in Texas, Louisiana, South Carolina, Florida, Wisconsin, Indiana, Georgia and Arizona. He currently provides nuclear plant operational monitoring services for GDS clients. Dr. Jacobs was a witness in nuclear plant certification hearings in Georgia for the Plant Vogtle 3 and 4 project on behalf of the Georgia Public Service Commission and in South Carolina for the V.C. Summer 2 and 3 projects on behalf of the South Carolina Office of Regulatory Staff. His areas of expertise include evaluation of reactor technology, EPC contracting, risk management and mitigation, project cost and schedule. He is assisting the Florida Office of Public Counsel in monitoring the development of four new nuclear units in the State of Florida, Levy County Units 1 and 2 and Turkey Point Units 6 and 7. He has been selected by the Georgia Public Service Commission as the Independent Construction Monitor for Georgia Power Company's new AP1000 nuclear power plants, Plant Vogtle Units 3 and 4. He has assisted the Georgia Public Service Commission staff in development of energy policy issues related to supply-side resources and in evaluation of applications for certification of power generation projects and assists the staff in monitoring the construction of these projects. He has also assisted in providing regulatory oversight related to an electric utility's evaluation of responses to an RFP for a supply-side resource and subsequent negotiations with short-listed bidders. He has provided technical litigation support and expert testimony support in several complex law suits involving power generation facilities. He monitors power plant operations for GDS clients and has provided testimony on power plant operations and decommissioning in several jurisdictions. Dr. Jacobs represents a GDS client on the management committee of a large coal-fired power plant currently under construction. Dr. Jacobs has provided testimony before the Georgia Public Service Commission, the Public Utility Commission of Texas, the North Carolina Utilities Commission, the South Carolina Public Service Commission, the Iowa State Utilities Board, the Louisiana Public Service Commission, the Florida Public Service Commission, the Indiana Regulatory Commission, the Wisconsin Public Service Commission, the Arizona Corporation Commission and the FERC.

A list of Dr. Jacobs' testimony is available upon request.

William R. Jacobs, Jr.
Executive Consultant

1986-Present GDS Associates, Inc.

As Executive Consultant, Dr. Jacobs assists clients in evaluation of management and technical issues related to power plant construction, operation and design. He has evaluated and testified on combustion turbine projects in certification hearings and has assisted the Georgia PSC in monitoring the construction of the combustion turbine projects. Dr. Jacobs has evaluated nuclear plant operations and provided testimony in the areas of nuclear plant operation, construction prudence and decommissioning in nine states. He has provided litigation support in complex law suits concerning the construction of nuclear power facilities. Dr. Jacobs is the Georgia PSC's Independent Construction Monitor for the Plant Vogtle 3 and 4 nuclear project.

1985-1986 Institute of Nuclear Power Operations (INPO)

Dr. Jacobs performed evaluations of operating nuclear power plants and nuclear power plant construction projects. He developed INPO Performance Objectives and Criteria for the INPO Outage Management Department. Dr. Jacobs performed Outage Management Evaluations at the following nuclear power plants:

- Connecticut Yankee - Connecticut Yankee Atomic Power Co.
- Callaway Unit I - Union Electric Co.
- Surry Unit I - Virginia Power Co.
- Ft. Calhoun - Omaha Public Power District
- Beaver Valley Unit 1 - Duquesne Light Co.

During these outage evaluations, he provided recommendations to senior utility management on techniques to improve outage performance and outage management effectiveness.

1979-1985 Westinghouse Electric Corporation

As site manager at Philippine Nuclear Power Plant Unit No. 1, a 655 MWe PWR located in Bataan, Philippines, Dr. Jacobs was responsible for all site activities during completion phase of the project. He had overall management responsibility for startup, site engineering, and plant completion departments. He managed workforce of approximately 50 expatriates and 1700 subcontractor personnel. Dr. Jacobs provided day-to-day direction of all site activities to ensure establishment of correct work priorities, prompt resolution of technical problems and on schedule plant completion.

Prior to being site manager, Dr. Jacobs was startup manager responsible for all startup activities including test procedure preparation, test performance and

William R. Jacobs, Jr.
Executive Consultant

review and acceptance of test results. He established the system turnover program, resulting in a timely turnover of systems for startup testing.

As startup manager at the KRSKO Nuclear Power Plant, a 632 MWE PWR near Krsko, Yugoslavia, Dr. Jacobs' duties included development and review of startup test procedures, planning and coordination of all startup test activities, evaluation of test results and customer assistance with regulatory questions. He had overall responsibility for all startup testing from Hot Functional Testing through full power operation.

1973 - 1979 NUS Corporation

As Startup and Operations and Maintenance Advisor to Korea Electric Company during startup and commercial operation of Ko-Ri Unit 1, a 595 MWE PWR near Pusan, South Korea, Dr. Jacobs advised KEPCO on all phases of startup testing and plant operations and maintenance through the first year of commercial operation. He assisted in establishment of administrative procedures for plant operation.

As Shift Test Director at Crystal River Unit 3, an 825 MWE PWR, Dr. Jacobs directed and performed many systems and integrated plant tests during startup of Crystal River Unit 3. He acted as data analysis engineer and shift test director during core loading, low power physics testing and power escalation program.

As Startup engineer at Kewaunee Nuclear Power Plant and Beaver Valley, Unit 1, Dr. Jacobs developed and performed preoperational tests and surveillance test procedures.

1971 - 1973 Southern Nuclear Engineering, Inc.

Dr. Jacobs performed engineering studies including analysis of the emergency core cooling system for an early PWR, analysis of pressure drop through a redesigned reactor core support structure and developed a computer model to determine tritium build up throughout the operating life of a large PWR.

SIGNIFICANT CONSULTING ASSIGNMENTS:

Georgia Public Service Commission – Selected as the Independent Construction Monitor to assist the GPSC staff in monitoring all aspects of the design, licensing and construction of Plant Vogtle Units 3 and 4, two AP1000 nuclear power plants.

Georgia Public Service Commission – Assisted the Georgia Public Service Commission Staff and provided testimony related to the evaluation of Georgia Power Company's request for certification to construct two AP1000 nuclear power plants at the Plant Vogtle site.

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South Carolina Office of Regulatory Staff – Assisted the South Carolina Office of Regulatory Staff in evaluation of South Carolina Electric and Gas' request for certification of two AP1000 nuclear power plants at the V.C. Summer site.

Florida Office of Public Counsel – Assists the Florida Office of Public Counsel in monitoring the development of four new nuclear power plants in Florida including providing testimony on the prudence of expenditures.

East Texas Electric Cooperative – Represented ETEC on the management committee of the Plum Point Unit 1 a 650 Mw coal-fired plant under construction in Osceola, Arkansas and represents ETEC on the management committee of the Harrison County Power Project, a 525 Mw combined cycle power plant located near Marshall, Texas.

Arizona Corporation Commission – Evaluated operation of the Palo Verde Nuclear Generating Station during the year 2005. Included evaluation of 11 outages and providing written and oral testimony before the Arizona Corporation Commission.

Citizens Utility Board of Wisconsin – Evaluated Spring 2005 outage at the Kewaunee Nuclear Power Plant and provided direct and surrebuttal testimony before the Wisconsin Public Service Commission.

Georgia Public Service Commission - Assisted the Georgia PSC staff in evaluation of Integrated Resource Plans presented by two investor owned utilities. Review included analysis of purchase power agreements, analysis of supply-side resource mix and review of a proposed green power program.

State of Hawaii, Department of Business, Economic Development and Tourism – Assisted the State of Hawaii in development and analysis of a Renewable Portfolio Standard to increase the amount of renewable energy resources developed to meet growing electricity demand. Presented the results of this work in testimony before the State of Hawaii, House of Representatives.

Georgia Public Service Commission - Assisted the Georgia PSC staff in providing oversight to the bid evaluation process concerning an electric utility's evaluation of responses to a Request for Proposals for supply-side resources. Projects evaluated include simple cycle combustion turbine projects, combined cycle combustion turbine projects and co-generation projects.

Millstone 3 Nuclear Plant Non-operating Owners – Evaluated the lengthy outage at Millstone 3 and provided analysis of outage schedule and cost on behalf of the non-operating owners of Millstone 3. Direct testimony provided an analysis of additional post-outage O&M costs that would result due to the outage. Rebuttal testimony dealt with analysis of the outage schedule.

H.C. Price Company – Evaluated project management of the Healy Clean Coal Project on behalf of the General Contractor, H.C. Price Company. The Healy Clean Coal Project is a 50 megawatt coal burning power plant funded in part by the DOE to demonstrate advanced clean coal

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technologies. This project involved analysis of the project schedule and evaluation of the impact of the owner's project management performance on costs incurred by our client.

Steel Dynamics, Inc. - Evaluated a lengthy outage at the D.C. Cook nuclear plant and presented testimony to the Indiana Utility Regulatory Commission in a fuel factor adjustment case Docket No. 38702-FAC40-S1.

Florida Office of Public Counsel - Evaluated lengthy outage at Crystal River Unit 3 Nuclear Plant. Submitted expert testimony to the Florida Public Service Commission in Docket No. 970261-EI.

United States Trade and Development Agency - Assisted the government of the Republic of Mauritius in development of a Request for Proposal for a 30 MW power plant to be built on a Build, Own, Operate (BOO) basis and assisted in evaluation of Bids.

Louisiana Public Service Commission Staff - Evaluated management and operation of the River Bend Nuclear Plant. Submitted expert testimony before the LPSC in Docket No. U-19904.

U.S. Department of Justice - Provided expert testimony concerning the in-service date of the Harris Nuclear Plant on behalf of the Department of Justice U.S. District Court.

City of Houston - Conducted evaluation of a lengthy NRC required shutdown of the South Texas Project Nuclear Generating Station.

Georgia Public Service Commission Staff - Evaluated and provided testimony on Georgia Power Company's application for certification of the Intercession City Combustion Turbine Project - Docket No. 4895-U.

Seminole Electric Cooperative, Inc. - Evaluated and provided testimony on nuclear decommissioning and fossil plant dismantlement costs - FERC Docket Nos. ER93-465-000, et al.

Georgia Public Service Commission Staff - Evaluated and prepared testimony on application for certification of the Robins Combustion Turbine Project by Georgia Power Company - Docket No. 4311-U.

North Carolina Electric Membership Corporation - Conducted a detailed evaluation of Duke Power Company's plans and cost estimate for replacement of the Catawba Unit 1 Steam Generators.

Georgia Public Service Commission Staff - Evaluated and prepared testimony on application for certification of the McIntosh Combustion Turbine Project by Georgia Power Company and Savannah Electric Power Company - Docket No. 4133-U and 4136-U.

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Executive Consultant

New Jersey Rate Counsel - Review of Public Service Electric & Gas Company nuclear and fossil capital additions in PSE&G general rate case.

Corn Belt Electric Cooperative/Central Iowa Power Electric Cooperative - Directs an operational monitoring program of the Duane Arnold Energy Center (565 Mwe BWR) on behalf of the non-operating owners.

Cities of Calvert and Kosse - Evaluated and submitted testimony of outages of the River Bend Nuclear Station - PUCT Docket No. 10894.

Iowa Office of Consumer Advocate - Evaluated and submitted testimony on the estimated decommissioning costs for the Cooper Nuclear Station - IUB Docket No. RPU-92-2.

Georgia Public Service Commission/Hicks, Maloof & Campbell - Prepared testimony related to Vogtle and Hatch plant decommissioning costs in 1991 Georgia Power rate case - Docket No. 4007-U.

City of El Paso - Testified before the Public Utility Commission of Texas regarding Palo Verde Unit 3 construction prudence - Docket No. 9945.

City of Houston - Testified before Texas Public Utility Commission regarding South Texas Project nuclear plant outages - Docket No. 9850.

NUCOR Steel Company - Evaluated and submitted testimony on outages of Carolina Power and Light nuclear power facilities - SCPSC Docket No. 90-4-E.

Georgia Public Service Commission/Hicks, Maloof & Campbell - Assisted Georgia Public Service Commission staff and attorneys in many aspects of Georgia Power Company's 1989 rate case including nuclear operation and maintenance costs, nuclear performance incentive plan for Georgia and provided expert testimony on construction prudence of Vogtle Unit 2 and decommissioning costs of Vogtle and Hatch nuclear units - Docket No. 3840-U.

Swidler & Berlin/Niagara Mohawk - Provided technical litigation support to Swidler & Berlin in law suit concerning construction mismanagement of the Nine Mile 2 Nuclear Plant.

Long Island Lighting Company/Shea & Gould - Assisted in preparation of expert testimony on nuclear plant construction.

North Carolina Electric Membership Corporation - Prepared testimony concerning prudence of construction of Carolina Power & Light Company's Shearon Harris Station - NCUC Docket No. E-2, Sub537.

City of Austin, Texas - Prepared estimates of the final cost and schedule of the South Texas Project in support of litigation.

William R. Jacobs, Jr.
Executive Consultant

Tex-La Electric Cooperative/Brazos Electric Cooperative - Participated in performance of a construction and operational monitoring program for minority owners of Comanche Peak Nuclear Station.

Tex-La Electric Cooperative/Brazos Electric Cooperative/Texas Municipal Power Authority (Attorneys - Burchette & Associates, Spiegel & McDiarmid, and Fulbright & Jaworski) - Assisted GDS personnel as consulting experts and litigation managers in all aspects of the lawsuit brought by Texas Utilities against the minority owners of Comanche Peak Nuclear Station.

James P. McGaughy, Jr.
Executive Consultant

GDS Associates, Inc.

EDUCATION: M.S., Mechanical Engineering, Stanford University, 1969
U.S. Navy Nuclear Power Training Program, 1964-65
B.S., Electrical Engineering, MIT, 1964

ENGINEERING REGISTRATION: Registered Professional Engineer (Retired)

Mr. McGaughy and five others founded GDS Associates, Inc. in 1986. Mr. McGaughy retired from GDS as an officer, board member and stockholder in May 2006. Since that time he has worked for GDS on various generation related consulting assignments on a part time basis.

EXPERIENCE:

While Mr. McGaughy was full time at GDS, he directed the power generation services function at GDS Associates, Inc. He has more than 40 years experience in the power generation field in the areas of licensing, design, construction, start-up, operation, and maintenance of nuclear and fossil-fired power plants. Mr. McGaughy has worked with top utility management to solve problems on a wide range of power generation issues. He has successfully managed extremely large and complex generation projects, both nuclear and fossil, which required the rigorous maintenance of project schedules and quality. He has performed studies concerning cogeneration projects involving unit dispatch and FERC operating and efficiency standards. Mr. McGaughy has provided testimony before the Texas Public Utility Commission, Public Utility Commission of Ohio, South Carolina Public Service Commission, Georgia Public Service Commission, Hawaii Public Utility Commission, New Jersey Board of Regulatory Commissioners, Michigan Public Utility Commission, Wisconsin Public Service Commission and FERC. He has performed work concerning over 30 nuclear units and 24 fossil-fired steam units as well as numerous combustion turbine and combined cycle units.

Specific Experience Includes:

2006-Present GDS Associates, Inc.

As an Executive Consultant, Mr. McGaughy has worked on various nuclear power plant related projects. He performed reviews of Palo Verde Nuclear Station operating and maintenance expenses for the City of El Paso in two El Paso Electric rate cases. He is assisting in the GDS ongoing Independent Construction Monitor program for the Georgia Public Service Commission and Georgia Power Company. Mr. McGaughy is working for the Florida Office of Public Counsel over the past four years in reviewing new nuclear units, Progress Energy Florida's (PEF) Levy 1&2 and Florida Power and Light's (FPL) Turkey Point 6&7. Mr. McGaughy is also reviewing the PFE and FPL extended uprate projects at all Florida nuclear units. Also for the Office of Public Counsel, Mr. McGaughy is reviewing the repair of the Crystal River 3 cracked containment building.

1986-2006 GDS Associates, Inc.

James P. McGaughy, Jr.
Executive Consultant

GDS Associates, Inc

As Vice President and Secretary, Mr. McGaughy served as head of the Generation Services Department of GDS. GDS has provided construction and operations monitoring program at five nuclear units and six coal-fired units for minority owners. GDS has provided expert witness and litigation support in lawsuits involving six nuclear units. Mr. McGaughy also has been responsible for prudence, construction monitoring and litigation support efforts at numerous other nuclear units and for development of a nuclear performance standard program for the Georgia Public Service Commission. He has testified on combustion turbine construction projects in certification proceedings and has testified on dispatch, reliability, avoided cost and other issues concerning cogeneration projects.

1984-1986 Southern Engineering Company

As Director of Generation Services, Mr. McGaughy conducted construction and operations monitoring for clients at power plants throughout the United States. In addition, Mr. McGaughy prepared testimony for various rate cases on generation matters at FERC and state commissions. He provided assistance to clients in all generation matters including contract administration and litigation support.

1980-1984 Mississippi Power and Light Company

Mr. McGaughy served as Vice President, Nuclear (1983-84) and Assistant Vice President, Nuclear Production (1980-82). He was responsible for all aspects of construction and operation of a multi-billion dollar power generation facility. In this capacity he hired and trained the nuclear power plant staff of over 500 people, including 29 licensed operators and numerous experienced utility managers. Mr. McGaughy also established a unique design engineering group which grew to over 125 people and had overall responsibility for interface with the Nuclear Regulatory Commission and all contractors on the project. During this tenure, cost and schedule performance was better than at any other similar plant (G.E. Boiling Water Reactor, BWR-6 design).

1973-1980 Mississippi Power and Light Company

Mr. McGaughy served as Director of Power Production (1978-80). In this capacity he was responsible for all power production related activities including construction, operation, engineering, maintenance, licensing, nuclear safety, staffing, and training. He prepared and administered annual personnel and operating budgets for 600 people and more than \$50 million, and an annual capital budget of \$280 million. He also established a formal screening program for hiring craft personnel, established a formal preventive maintenance program, and reorganized his department based on job performance. He served as project manager for 2-unit, 1,600 MW coal project.

Mississippi Power and Light Company

Mr. McGaughy served as Nuclear Project Manager (1976-78) and Assistant Project Manager (1973-75). He was responsible for forming and managing an organization to control the prime contractor on a \$4 billion construction project. He began the formation of plant staff

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Executive Consultant

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organization. He was also responsible for relations with the Nuclear Regulatory Commission and the prime contractor (Bechtel). The construction permit was awarded in record time.

1971-1973 Middle South Services, Inc.

Mr. McCaughy served as a nuclear engineer on the holding company staff responsible for economic and engineering studies including the feasibility evaluation for Grand Gulf Nuclear Station. He performed nuclear fuel and uranium buying functions. He also performed generation-mix studies.

1969 - 1971 Arkansas Power and Light Company

Mr. McCaughy was responsible for nuclear fuel procurement and performed the licensing work including the preparation of the Safety Analysis Report for Arkansas Nuclear One, Unit 2.

1964-1968 U.S. Navy

Served as an engineering officer on nuclear propulsion power plants aboard navy submarines.

SIGNIFICANT CONSULTING ASSIGNMENTS:

Pacific Gas & Electric Company – Performed technical analyses of two different cogeneration plants to determine if projects had met FERC and state efficiency and operating standards.

Niagara Mohawk Power Corporation/Swidler & Berlin – Assisting in FERC proceeding to set new rates for disqualified former QF.

Niagara Mohawk Power Corporation/Swidler & Berlin – Prepared extensive technical analysis for filing in federal court and at FERC concerning efficiency and operating standards of cogeneration facility in support of motion to revoke QF certification.

Attorney General, State of Michigan – Prepared analysis and testimony concerning power plant availability and system dispatch relating to the Midland cogeneration project in Consumers Power fuel plan case.

Attorney General, State of Michigan – Prepared analysis and testimony concerning purchased power costs relating to the Midland cogeneration project in Consumers Power fuel reconciliation case.

Attorney General, State of Michigan – Prepared analysis and testimony concerning avoided costs, PURPA rates, reserve margins, plant availability and dispatchability in MCV cogeneration facility settlement case.

U-10127.

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Attorney General, State of Michigan – Analysis and testimony concerning Consumers' application of requirements of order in Case No U-10127 relating to the Midland cogeneration project

North Carolina Electric Membership Cooperative – Performed due diligence review of management for a 3-site, 1,200 MW, peaking project. Reviewed management site selection, fuel, equipment selection, environmental, contracting and other aspects.

VECO Alaska, Inc. – Served as construction project management expert witness for EPC contractor in lawsuit concerning construction overruns in a turnkey cogeneration project in Alaska. Served as witness in successful mediation.

H.C. Price Construction Company – Provided detailed analysis and mediation presentations concerning construction project management in case involving construction contractor and owner (State of Alaska) of a coal-fired plant in Alaska.

Rusk County, Texas Rural Electric Cooperative/Richard Balough – Testified before the Texas Public Utility Commission concerning coal-fired plant station electric service in territorial dispute with Texas Utilities.

Sam Rayburn G&T – Ongoing operational monitoring program concerning client's interest in Nelson 6 Coal Station operated by Gulf States Utilities.

Kamo Electric Cooperative – Operational monitoring program for client's minority interest in GRDA Unit 2 Coal Fired Station.

Northeast Texas Electric Cooperative – Ongoing construction monitoring and operational monitoring program concerning NTEC's interest in Pirkey Coal Station operated by Southwestern Electric Power Company and Dolet Hills Station operated by Central Louisiana Electric Company.

Sawnee and Coweta/Fayette Electric Membership Cooperatives – Served as Owner's project monitor on Sewell Creek Combustion Turbine Plant, Doyle Combustion Turbine Project, Chattahoochee Combined Cycle Project and Talbot County Combustion Turbine Project.

Northeast Texas Electric Cooperative – Served as Owner's representative on Project Management Committee for design, construction and operation of 500Mw combined cycle plant.

U.S. Department of Justice – Served as expert witness in two tax cases involving investment tax credits for nuclear fuel

Steel Dynamics, Inc. – Analysis of imprudence and replacement power costs at D.C. Cook Plant.

Coin Belt Power Cooperative – Performed review of available options for board of directors with recommendations for future plan of action.

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East Texas Electric Cooperative – Assisted cooperative in negotiating steam and electric service contract with industrial customer.

Georgia Public Service Commission Staff – Testified before the Georgia Public Service Commission recommending that a nuclear performance standard be implemented in the State of Georgia. The Commission implemented the recommended standard.

City of El Paso – Testified before the Public Utility Commission of Texas regarding Palo Verde operations and maintenance expenses.

City of El Paso – Testified before the Public Utility Commission of Texas regarding valuation of Palo Verde power plant and other merger issues.

City of Homestead, Florida/Spiegel & McDiarmid – Assisted City in lawsuit regarding DeLaval Diesel-Generators. Prepared expert testimony and gave major deposition on subject before favorable settlement

El Paso Community College/Law offices of Jim Boyle – Prepared testimony concerning level of Palo Verde Nuclear Station operation and maintenance costs requested by El Paso Electric. Analysis was performed on bases of comparative studies and on specific analysis of cost filed by El Paso Electric.

Old Dominion Electric Cooperative – Prepared testimony filed at FERC concerning prudent levels of coal inventory for inclusion Virginia Power working capital.

Long Island Lighting Company/Shea & Gould – Prepared expert testimony on nuclear plant construction.

Ohio Public Service Commission – Prepared testimony related to decommissioning costs of Toledo Edison's Davis-Besse Nuclear Station.

Georgia Public Service Commission/Hicks, Maloof & Campbell – Assisted Georgia Public Service Commission staff and attorneys in many aspects of Georgia Power Company's 1989 rate case including analysis of service company charges, construction prudence of Vogtle Unit 2, decommissioning costs of Vogtle and Hatch nuclear units, prepared expert testimony on operation and maintenance costs for Hatch and Vogtle nuclear units, prepared expert testimony on Performance Incentive Plan for Georgia Power nuclear units.

Georgia Public Service Commission/Hicks, Maloof & Campbell – Prepared testimony related to Vogtle and Hatch plant operations and maintenance costs in 1991 Georgia Power rate case.

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Georgia Public Service Commission Staff – Prepared testimony concerning certification of McIntosh Units, Warner Robins Units, Intercession City Unit and Florida Power Corporation Power Purchase (three separate dockets)

City of Houston – Testified before Texas Public Utility Commission regarding South Texas Project operation and maintenance expenses.

Sam Rayburn G&I – Prepared testimony before Texas Public Utility Commission concerning certificate of convenience and necessity for co-op purchase of 38 mw interest in an existing coal-fired plant

Aetna Insurance Company/Dickson, Carlson & Campillo – Assisted attorneys in analysis of Southern California Edison claims of property damage and replacement power costs. Prepared written analyses used in achieving favorable settlements for clients.

East Texas Electric Cooperative – Performed economic and technical feasibility analyses on hydro and thermal generation alternatives.

Allegheny Electric Power Cooperative – Assisted co-op in review of various financial and technical issues of Susquehanna Nuclear Station.

Saluda River Electric Cooperative – Assisted co-op in review of technical issues including decommissioning and minimum net dependable capability ratings for the co-op's minority interest in Catawba Nuclear Station operated by Duke Power Company.

City of Midland, Michigan – Assisted city in tax assessment case concerning Midland Nuclear Plant with Consumer's Power Company.

City of Wallingford, Connecticut – Reviewed decommissioning costs of Millstone Nuclear Units 1, 2, and 3 in CP&L rate case at FERC.

Nucor Steel/Ritts, Brickfield & Kaufman – Prepared testimony concerning prudence of construction of Carolina Power & Light Company's Sheron Harris Station.

City of Austin, Texas – Review of cost and schedule of South Texas Nuclear Plant.

Sam Rayburn Municipal Power Authority – Performed operational monitoring program relative to the client's minority interest in Nelson 6 Coal Station operated by Gulf States Utilities.

Tex-La Electric Cooperative/Brazos Electric Cooperative – Conducted construction and operational monitoring program for minority owners of Comanche Peak Nuclear Station.

Tex-La Electric Cooperative/Brazos Electric Cooperative/Texas Municipal Power Authority (Attorneys - Burchette & Associates, Spiegel & McDiarmid, and Fulbright & Jaworski) – Assisted attorneys as consulting experts and litigation managers in all aspects of the lawsuit brought by Texas Utilities against the minority owners of Comanche Peak Nuclear Station.

James P. McGaughey, Jr.
Executive Consultant

GDS Associates, Inc.

New Jersey Rate Counsel – Review of Public Service Electric & Gas Company nuclear and fossil O&M costs and capital additions in PSE&G general rate case.

Late Filed Exhibit to
 Witness Jones Deposition, June 17, 2013
 Docket No. 130009-EI

Please see the below break down of the Transmission Incremental Capital line item and the Estimated NBV of Retirements line item (from FPL's response to OPC's First Set of Interrogatories No. 1) between Turkey Point and St. Lucie.

Additionally, the 2013 actual/estimated EPU costs presented on page 10 of Terry Jones's May 1, 2013 testimony (a total of \$243 million) includes approximately \$16 million in St. Lucie costs and approximately \$227 million in Turkey Point costs.

Description	2008	2009	2010	2011	2012	Total
PSL Incremental Capital	61	112	145	318	430	1,066
PTN Incremental Capital	42	122	161	344	675	1,644
PSL Transmission Incremental Capital	-	-	-	-	-	0
PTN Transmission Incremental Capital	-	-	2	3	12	17
Participation on Incremental Capital	(4)	(9)	(9)	(20)	(26)	(68)
PSL Recoverable O&M Net of Participation	0	0	2	3	3	8
PTN Recoverable O&M	0	0	6	8	5	19
PSL Salvage Net of Participation	-	-	(0)	(0)	(0)	(1)
PTN Salvage	-	-	-	(0)	(1)	(1)
PSL Removal Cost	-	0	0	7	15	23
PTN Removal Cost	-	-	0	0	47	48
PSL Estimated NBV of Retirements	-	0	0	3	30	33
PTN Estimated NBV of Retirements	-	-	-	-	3	3
PSL Asbestos Abatement	-	-	3	0	1	4
PTN Asbestos Abatement	-	-	0	0	6	6
Non-Incremental Capital	-	1	0	0	2	4
Jones Testimony, page 4, line 11	99	227	315	679	1,537	2,858
Total Carrying Charges on Construction	2	18	46	85	112	263
Total Carrying Charges DTA/DTL	(0)	(2)	(3)	(3)	(1)	(9)
Investment Including Carrying Charges Net of Participants	101	244	359	760	1,647	3,112

Docket No. 130009-EI
Exhibit No. WRJ-4

WITHDRAWN

Docket No. 130009-EI
Exhibit No. WRJ-5

WITHDRAWN

Docket No. 130009-EI
Exhibit No. WRJ-6

WITHDRAWN

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Successful Software Management: How to Improve Your Decision Making - Sunk Costs

As business leaders, we are often called on to make decisions about which option or project we should pursue. Today, we'll talk about one consideration to help you improve those decisions: sunk costs.

What are Sunk Costs?

When making business decisions, each option you face has associated future costs and associated future revenues. Typically, you will compare the future revenues to the future costs, and adjust for the timing of the cash flows and for the risks involved. This provides a comparison of the likely profitability of each option.

Sunk costs are money that you've already spent on one of the options, before making the decision. Regardless of which option you choose, the money has already been spent. That money is, for all intents and purposes, gone. If you choose option A, the money is spent. If you choose option B, the money is spent. If you choose to do nothing, the money has still been spent. The result is that *sunk costs should not be considered in your decisions*. Sunk costs do not alter the future costs and revenues of your options, so they should not be included in the analysis.

Let's say you have two innovation projects. Project 1 has invested \$100K so far. Project 2 has invested only \$10K so far. You only have the budget to continue with one project. Which one should you choose?

The answer is: Whichever project has the best future return for the company. The money spent in the past is irrelevant, because you can't get that money back. If project 2 has better future returns, but you choose to proceed with project 1, you are essentially "throwing good money after bad". That is, you are wasting more money on an inferior project, just because you wasted money on it in the past.

HOME

SOME PAST ARTICLES

THE 10 THINGS YOU MUST DO
DIFFERENTLY TO INNOVATE

DISRUPTIVE INNOVATION - HOW TO
MAKE IT WORK

DO YOU TRACK THE RIGHT
OBJECTIVES?

DOES YOUR RISK REGISTER LOOK
LIKE THIS?

FIND HIDDEN PROJECT RISKS

HOW DO YOU MANAGE
UNCERTAINTY IN YOUR ESTIMATES?

HOW TO IMPROVE YOUR DECISION
MAKING - SUNK COSTS

WHEN SHOULD EXECUTIVES DRIVE
INNOVATION?

WHEN SHOULD INTRAPRENEURS
TAKE THE LEAD?

WHY DO PROJECTS FAIL?

Doesn't Everyone Exclude Sunk Costs?

Although excluding sunk costs from your decisions seems to make sense, managers very frequently fall into the trap of continuing a losing investment just because they've already invested in it. There are a few reasons for this:

Over-optimism: In a study in the *Journal of Personality and Social Psychology*, researchers found that once an investment has been made, the investor has a stronger belief that the investment will succeed than before they had made the investment. This has a direct parallel in business. Many projects slip from month to month to month, because managers repeatedly believe that they are "almost there". However, if they approached the analysis of future costs, revenues, and risks more objectively, they might instead cancel the project and invest in an opportunity with a better likelihood of success.

Over-optimism also causes some managers to believe in a "sunk cost dilemma". This is the belief that ignoring sunk costs will lead to an overall bad outcome for the company. An example: After its first month, a project has over-run its costs and missed its revenue forecasts. However, those costs are sunk and should be ignored. Looking at the forecasts, the project still looks promising, so the project proceeds. After the second month, the project has missed its estimates again and has lost even more money. But these are sunk costs and are ignored. The manager, looking forward, only sees a rosy picture, and the project proceeds. This continues from month to month, until the project completes, showing a large financial loss for the company.

The problem here does not come from ignoring sunk costs. The problem comes from being *over-optimistic* about the future outcomes. After repeatedly missing past forecasts, managers should be that much more diligent about ensuring that future estimates are realistic, instead of getting caught in the trap of repeatedly believing questionable estimates, when past evidence suggests that they are unreliable. To put it another way, ignore sunk costs, but don't ignore what you've learned.

Personal responsibility: In several studies, including one published in *Organizational Behavior and Human Decision Process*, researchers found that if a manager feels responsible for the sunk cost, then they are more likely to want to continue that investment, even in the face of better investment options. This is human nature -- none of us likes admitting that we were wrong or did a poor job. If you are in this scenario, beware! Often, how you respond to your mistake is much more important than the mistake itself. If your project didn't work out, learn to walk away and avoid the same mistakes on the next project. If you ignore the data and continue a failing

investment, you will soon find yourself in an even deeper hole

Loss aversion: When you walk away from a project with sunk costs, many people feel that they are "wasting" past investments. Of course, the true waste is continuing to invest in a losing proposition, when that money could be better spent elsewhere. However, this psychological barrier is a difficult one to overcome. Some may say, "We've spent so much on this already, it would be a shame to throw that away." Focus on the future, on how much future money you expect to make for your future expenses. That will help you avoid turning a loss into a larger loss

Note also that putting a project on hold doesn't mean your investment is lost. Frequently, a cancelled project has still created some useful assets, such as intellectual property, that you may be able to reuse in other projects later.

When Should You Consider Sunk Costs?

Although you'll never include sunk costs directly in your analysis, you should make sure you include all the benefits of your past investment in the decision. Here are some examples:

When the past investment reduces the cost of a future option: Frequently, when sunk costs are involved, you are comparing completing an existing project to implementing a new project from scratch. Of course, the future cost for the existing project is less than its total cost, because you've already incurred part of the cost of the project. However, abandoning the project and proceeding with another option may still show the best financial return, especially if the project is slipping and is likely to slip further.

When the past investment creates a barrier to entry against your competitors: Sunk costs can represent a real barrier to entry for your competitors, if competitors would have to make a similar investment to compete with you. An example of this is when creating an innovative new product. A product with a barrier to entry means that your market share (that is, your future revenues) could be protected from imitation longer than it would be for a second product which is cheaper for a competitor to copy. In this scenario, make sure that the revenue forecasts for your options reflect this. The revenues for the product with the barrier to entry should remain higher for longer, when compared to the product without a barrier to entry. After all, the faster competitive products appear, the sooner they're likely to start competing on price. Note that you're still not including the sunk cost itself in the analysis. Instead, you're including the *result* of the investment (i.e. higher future revenues) in your analysis.

How to Avoid Hard Decisions

Regardless of how you look at it, walking away from sunk costs is a hard decision to make. So how can you avoid having to make these hard decisions?

Evaluate the project, not the person: We already discussed that the sense of responsibility makes it difficult to step away from sunk costs. To make this easier, remember that you are evaluating the project, not the person running the project. If you focus on the person, they will often become defensive, and promote staying the course, when a change in course is required. But if you focus on the merits of the options themselves, and take the person out of the equation, it becomes much easier for the people involved to step back and look at the decision objectively.

Ask hard questions early: The best way to avoid having to make hard decisions is to ask hard questions earlier in the project, to make sure the team is learning about its costs, its target market (i.e. future revenues), and is getting its risks under control. Avoid unrealistic optimism -- frequently reality check your forecasts, and make sure the team is steadily reducing its risk. If the team is not getting its risks under control, it might be easier to put the project on hold early in the project, or even to step back to performing feasibility studies, rather than wait until the investment has become significant. Successful entrepreneurs understand this concept intuitively. If an idea is not working out, they move on to the next one, before they've invested too much in it.

Iterate rapidly and inexpensively: When your software activities are implemented iteratively, and each iteration is rapid and inexpensive, then you have built-in milestones where the project can be evaluated objectively. If you decide that a project does have to be cancelled or changed significantly, then you've minimized your past investment, and the team has a point where they can change course quickly and easily.

Lastly

I've touched on several topics in recent weeks. **Which ones are most important to you?** Innovation, culture, risk, and software management techniques are each large topics, and I want to make sure that you're getting value out of these articles. Let me know..

Of course, if you have any questions, or if you would like more information on how to implement these or other software development processes in your organization, please feel free to contact me at Charles@CharlesConway.com.

If you know of someone who may find this article of interest,
please forward it on!

Good luck!
Charles

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