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Arizona Corporation Commission  
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March 7, 2011

Docket Control  
Arizona Corporation Commission  
1200 W. Washington  
Phoenix, AZ 85007

RE: Arizona Public Service Company Renewable Transmission Projects  
Decision No. 72057; Docket No. E-01345A-10-0033

Pursuant to Decision No. 72057, dated January 6, 2011:

IT IS FURTHER ORDERED that Arizona Public Service Company shall file in this Docket within 60 days of the effective date of this Order, an economic impact analysis which includes estimates of the number of jobs created, types of jobs created, tax bas impacts, and other similar economic impacts.

Attached is the economic impact analysis, which was performed by Applied Economics for Arizona Public Service in compliance with the above requirement. The report is intended to aid in the quantification of the impacts of renewable transmission line projects and solar photovoltaic plants on the local economy.

If you have any questions regarding this information, please contact Jeff Johnson at (602) 250-2661.

Sincerely,

  
Susan Casady

SC/kc

cc: Brian Bozzo



**ECONOMIC IMPACTS  
OF RENEWABLE TRANSMISSION AND  
SOLAR PHOTOVOLTAIC PLANTS  
ON THE STATE OF ARIZONA**

**PREPARED BY:**

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**FEBRUARY 2011**

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## 1.0 Introduction

The purpose of this report is to demonstrate the estimated economic impact analysis of renewable transmission lines and related solar photovoltaic ("PV") plants in the State of Arizona that could result from Arizona Public Service's ("APS") Renewable Transmission Action Plan ("RTAP" or "renewable transmission") approved in Commission Decision No. 72057 (January 6, 2011). It is likely that the type of plants described in this analysis would be constructed in the western part of the state and be connected to the Arizona Public Service Company APS grid system. This analysis includes the construction impacts for two sizes of solar plants and related transmission lines, as well as the ongoing operations and maintenance impacts associated with the plants and the transmission lines. It includes estimates of the number of jobs created directly and indirectly, the types of jobs created, associated income and output impacts, and indirect tax base impacts.

Since no such plants currently exist in Arizona at the size and technology type used for this analysis, pro-formas from proposed facilities in San Luis Obispo County, California were used. Detailed information about operating costs, employment and wage costs were taken from a report prepared by Aspen Environmental Group for the Topaz Solar Farm. The analysis includes a pro-forma for a 550MW plant as well as a 250MW plant (Figure 1). The purpose of showing both is to illustrate that the impacts of a larger plant are not directly proportional to the impacts of a smaller plant. The analysis also include the impacts of two proposed RTAP transmission line projects: the 18 mile Delaney to Palo Verde project at an estimated cost of \$68.8 million, and the 114 mile Palo Verde to North Gila project which would cost approximately \$242.5 million. The information on the cost of transmission lines used in this analysis was provided by APS based on projects included in APS's RTAP.

**FIGURE 1**  
**SOLAR PLANT PROJECT DESCRIPTION**

	Operations			Capital Investment (millions)	
	Jobs	Payroll	Operating Cost	Construction Supplies	Construction Labor
250 MW plant	11	\$935,000	\$2,900,000	\$1,374.0	\$49.4
500 MW plant	17	\$1,445,000	\$7,100,000	\$1,625.0	\$92.2

Source: First Solar, 2010; Aspen Environmental Group, "Socioeconomic and Fiscal Impacts of the California Valley Solar Ranch and Topaz Solar Farm Projects on San Luis Obispo County"; APS Renewable Transmission Action Plan, October 2009.

The information and observations contained in this report are based on our present knowledge of the components of development, and of the current physical, socioeconomic and fiscal conditions of the affected areas. Estimates made in this analysis are based on hypothetical assumptions, current tax policies, and the current economic structure of the state. However, even if the assumptions outlined in this report were to occur, there will usually be differences between the estimates and the actual results because events and circumstances frequently do

not occur as expected. This analysis is based on the best available information and is intended to aid APS in quantifying the impacts of solar plants and RTAP transmission line projects on the local economy. In no way will Applied Economics be held responsible, have any liability or be subject to damages as a result of this analysis. This report may be used only for the purposes that it was intended.

## 2.0 Summary of Findings

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The operations of new solar photovoltaic plants and related transmission lines in western Arizona would provide a variety of economic benefits to the state. Economic impacts measure the effects of economic stimuli, or expenditures, in the local economy. These impacts include direct and indirect jobs, personal income, and economic activity, or output, that are generated by the solar plants and RTAP transmission lines. Indirect impacts are the result of the multiplier effect as described later in this report and capture supported supplier and consumer businesses and their employees that would benefit from these types of facilities.<sup>1</sup>

### Economic Impacts

- **Construction Impacts of RTAP Transmission Lines.** About 2,600 direct construction jobs and 2,400 additional indirect jobs would be created in Arizona through the new construction activity associated with the RTAP transmission line projects from Delaney to Palo Verde and Palo Verde to North Gila. The total combined construction costs are estimated at \$311.3 million. This would result in a one-time economic impact of \$614.2 million. In addition, about \$16.4 million in one-time construction sales tax to state and local governments could also be generated by these two projects combined.
- **Construction Impact of Solar PV Plants.** The RTAP transmission lines would be available to support new solar PV plants in western Arizona. Depending on the size, a plant of this type could generate local construction impacts of \$97.5 million to \$181.9 million and support 800 to 1,500 direct and indirect jobs in the state during the approximately three year construction phase.
- **Operations Impacts.** In addition to construction impacts, these facilities also create on-going operations impacts. The two transmission line projects would support about 7 direct jobs and 13 total jobs for on-going maintenance activities. This would result in an annual economic impact of \$1.4 million. These operations impacts are in addition to the construction impact detailed above. A solar PV plant could support 11 to 17 permanent jobs, depending on the size of the plant, and create an annual economic impact of \$4.2 million to \$10.5 million on the state.
- **Jobs and Income.** A 550 MW solar PV plant would directly employ about 17 people with an estimated payroll of \$1.4 million annually. Through the multiplier effect, an additional 27 jobs and \$1.2 million in annual payroll could be supported at other local businesses. The additional jobs and payroll at other local businesses stem from indirect

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<sup>1</sup> Economic multipliers capture the interactions between industries, government and households within the local economy based on a national transactions matrix that is adjusted for the local industry structure. Multipliers vary across different sectors of the economy based on the mix of labor and other inputs and the propensity of each sector to buy goods and services from within the region.

impacts of supplier demand created by the solar plant and consumer demand created by its employees.

### **Revenue Impacts**

- **Direct Revenue Impacts.** In addition to one-time construction sales taxes, both the transmission lines and the solar PV plants could generate significant on-going local property tax revenues.
- **Indirect Revenue Impacts.** Along with direct revenues, the direct and indirect employees associated with the solar plant and the transmission lines would generate indirect sales and property tax revenues as well as state income tax revenues. Indirect revenues are estimated at \$579,000 per year for the two transmission line projects and \$1.4 million to \$2.6 million per year for a solar PV plant.

The attraction of this type of generation facility to Arizona will not only create new quality jobs, but will provide the region with additional sustainable sources of power generation. As Arizona develops its solar generation portfolio, the state will also become more attractive to local suppliers of photovoltaic panels and related products, thereby increasing the local economic impact of the solar industry.

### 3.0 Economic Impacts

The economic benefits resulting from the construction of solar PV plants and related renewable transmission lines in western Arizona include both the one-time construction impacts and on-going operations impacts. These impacts include direct and indirect jobs, personal income and economic activity or output that would be generated by the project. Indirect impacts are the result of the multiplier effect and capture supported supplier and consumer businesses and employees throughout Arizona that would benefit from this new facilities. There are additional positive impacts that would occur outside the state that are not shown in this report.

#### Economic Impacts of Construction

Total personal income and jobs, as well as the total increase in economic activity from new construction expenditures, are shown in Figure 2 for both the 250MW and 550MW plants and the two proposed transmission line projects. It is estimated that PV plant construction would take about 36 months. The solar PV plants would result in direct local construction expenditures of about \$49 million to \$92 million, excluding the cost of equipment which is not produced locally. Most of the activity would occur at the site of construction; however some of the direct expenditures for professional services and various other support services would occur in other parts of the state.

The estimated construction costs for the RTAP transmission lines would be \$68.8 million for the Delaney to Palo Verde project, and \$242.5 million for the Palo Verde to North Gila project. These represent total cost, not just APS's share, and do not include integration costs associated with the integration of a renewable generation resource into an electric supply system.

**FIGURE 2  
CONSTRUCTION IMPACT OF SOLAR PLANTS  
ON THE STATE OF ARIZONA**

	Direct			Total		
	Construction Expenditures	Jobs <sup>1</sup>	Personal Income	Output	Jobs <sup>2</sup>	Personal Income
<b>Transmission Lines</b>						
Delaney to Palo Verde	\$68,750,000	576	\$29,091,028	\$135,670,684	1,101	\$53,121,573
Palo Verde to North Gila	\$242,500,000	2,030	\$102,611,989	\$478,547,505	3,883	\$187,374,275
<b>250 MW PV Solar Plant</b>	\$49,400,000	414	\$20,903,226	\$97,485,554	791	\$38,170,265
<b>550 MW PV Solar Plant</b>	\$92,200,000	772	\$39,013,713	\$181,946,721	1,476	\$71,240,858

Note: Transmission line construction does not include integration costs. Solar plant construction costs exclude equipment and materials purchased outside the state.

<sup>1</sup> Direct jobs related to transmission line construction represent actual construction workers as well as engineering, site work and other related services included in the construction cost. These are high level estimates based on IMPLAN data for Arizona on average production levels per worker in heavy construction.

<sup>2</sup> Total jobs include the direct jobs plus incremental increases in supported jobs at local suppliers related to the project, as well as additional jobs at retail and service establishments where construction workers make consumer purchases during the construction period.

Over the multi-year construction period the multiplier effect of this construction activity on the state would result in a total construction impact of \$97.5 million over a three year period for the 250MW solar plant, supporting about 800 jobs and \$38.2 million in additional personal income. The larger 550MW plant would create a construction impact of \$181.9 million over three years, supporting about 1,500 jobs and \$71.2 million in income. These economic impacts reflect the direct construction expenditures for the solar PV plants, as well as the additional demand for suppliers in other parts of the state, and the additional demand for consumer goods by construction employees.

The RTAP transmission lines would generate a total increase in economic activity of about \$135.7 million for the Delaney to Palo Verde project, supporting over 1,100 jobs and about \$53.1 million in personal income. The larger Palo Verde to North Gila project, which would cover 114 miles, would have an economic impact of \$478.5 million and support over 3,900 jobs in construction and related industries in the state. The total economic impact shown in Figure 2 reflects construction activity as well as local supplier purchases and consumer purchases made by construction employees.

All of the construction activity would generate one-time construction sales tax revenues to state and local governments. Construction sales tax is estimated at \$3.6 million for the Delaney to Palo Verde project and \$12.8 million for the Palo Verde to North Gila project. Based on the estimated cost of supplies and materials for the solar plant construction, those facilities could generate between \$72 million and \$86 million in construction sales tax to state and local governments in Arizona.

### **Economic Impacts of Operations**

Total economic output from the operations and maintenance of the renewable transmission lines and the solar PV plants, and the total increase in jobs and personal income from operations are shown in Figure 3. These impacts are projected to occur on an annual basis once the facilities are complete. The 250MW plant would create an estimated 11 permanent jobs, while the 550MW plant would create about 17 jobs, representing a less than proportional increase. On average, the income from these jobs is estimated at about \$85,000 per employee, excluding benefits. Total annual operating expenditures are used as a proxy for direct output.



**FIGURE 3**  
**ANNUAL OPERATIONS IMPACT OF SOLAR PLANTS**  
**ON THE STATE OF ARIZONA**

	Direct			Total		
	Output	Jobs	Personal Income	Output	Jobs	Personal Income
<b>Transmission Line Maintenance</b>						
Delaney to Palo Verde	\$99,828	1	\$46,143	\$191,740	2	\$78,901
Palo Verde to North Gila	\$632,244	6	\$292,241	\$1,214,351	11	\$499,707
250 MW PV Solar Plant	\$2,900,000	11	\$935,000	\$4,285,446	22	\$1,410,887
550 MW PV Solar Plant	\$7,100,000	17	\$1,445,000	\$10,491,954	44	\$2,610,104

Note: Transmission line maintenance cost based on \$5,546 per mile per year.

The multiplier effect of the increase in economic activity created by the solar plants could result in a total economic impact of \$4.3 million to \$10.5 million per year, supporting a total of 20 to 40 total jobs at the plants, and at other local businesses throughout the state. Although the operations impacts are much less than the construction impacts, the PV plants support high-paying quality jobs and create some additional demand for local suppliers.

The economic impacts for the RTAP transmission lines are based on annual maintenance costs of \$5,546 per mile.<sup>2</sup> This would support one full time equivalent job to maintain the lines for the Delaney to Palo Verde line and 6 jobs to maintain the Palo Verde to North Gila line. Additional demand created by local supplier purchases and additional consumer demand created by the employees would result in about 5 new jobs at other local businesses in the state for the two lines combined, along with \$240,000 in additional personal income. This is in addition to the 7 jobs and \$338,000 in income for line maintenance directly. The total economic impact of the transmission lines would be about \$191,000 per year for the Delaney to Palo Verde line and \$1.2 million for the Palo Verde to North Gila line, or about \$10,700 per mile.

The secondary or indirect impacts of the solar plant operations are called multiplier effects. Multiplier effects are a way of representing the larger economic effects on the local economy. The multipliers translate an increase in output (loosely defined as sales, less profits) into a corresponding increase in jobs and personal income. In essence, the multiplier effect represents the recycling of local spending. This recycling process creates new business opportunities.

The multipliers used in this analysis are from IMPLAN, a national vendor of economic impact software, and are specific to Arizona. Industry specific multipliers were used for both construction and operations. They are based on an input-output model for each location that

<sup>2</sup> Arizona Public Service, "Biennial Transmission Assessment, Economic Assessment of Potential Wind and Solar Generation in Arizona," October 27, 2009.

mathematically analyzes transactions between industries, households and government. For example, the output multiplier for operations is 1.92 for the transmission lines and 1.48 for the solar plants. This means that for every \$1 million of maintenance expenditures create by the transmission lines, an additional \$920,000 in economic activity is generated in the state's economy, along with about 7.4 jobs and \$328,000 in payroll or personal income at related local businesses. For every \$1 million of value created by the PV plants, an additional \$480,000 in economic activity is generated at other local businesses along with 3.8 jobs and \$164,000 in payroll. The local economic impacts of the solar plants could increase over time as a larger local supplier network is created in this relatively new industry.

## 4.0 Revenue Impacts

In addition to supporting jobs and economic activity in the state through multiplier effects, these projects and their employees will also create revenue impacts on state and local governments. This analysis does not include direct property taxes or other revenue impacts associated with the transmission lines or the PV plants. However, it does include the revenue generated by direct and indirect employees that are supported by these projects.

### State and Local Revenue Impacts

Along with the direct taxes paid by APS, or the ultimate owners of the solar plants and transmission lines, there are also indirect taxes generated by employees. Using the results from the economic impact analysis, it is possible to estimate indirect tax impacts including sales tax on local retail purchases, property tax on primary residences and personal income tax on earnings. The transmission lines would result in an average of \$369 in indirect state and local revenues per mile per year. The revenue impacts generated by the solar plants vary depending on the size of the plant, but would be equal to an average of \$10,600 per direct job per year.

**FIGURE 4**  
**ANNUAL INDIRECT REVENUE IMPACT OF SOLAR PLANTS**  
**ON THE STATE OF ARIZONA**

	Local		State		Total Revenues
	Sales Tax <sup>1</sup>	Property Tax	Sales Tax <sup>1</sup>	Income Tax	
Transmission Line Maintenance					
Delaney to Palo Verde	\$489	\$2,632	\$1,492	\$2,024	\$6,637
Palo Verde to North Gila	\$3,098	\$16,666	\$9,449	\$12,820	\$42,034
250 MW PV Solar Plant	\$8,748	\$27,448	\$26,680	\$40,754	\$103,630
550 MW PV Solar Plant	\$16,183	\$54,768	\$49,357	\$81,316	\$201,624

Note: All figures are in 2011 dollars.

<sup>1</sup> Based on average local sales tax rate of 2 percent and state rate of 6.1 percent

Indirect property tax revenues were based on average residential assessed value per capita, times the annual supported population based on total job impacts, times the average property tax rate. Maricopa County residential assessed value per capita and average tax rates were used for the transmission lines. A two-county average for Maricopa and Yuma Counties was used for the solar plants. Indirect property taxes are estimated at about \$27,000 to \$55,000 per year to school districts and local governments for the solar plants, \$2,600 for the Delaney to Palo Verde project, and \$17,000 for the Palo Verde to North Gila Project. This is in addition to direct property taxes generated by the transmission lines and the solar plants.

Indirect sales tax revenues include sales taxes from direct employees and employees at supported local businesses. Indirect sales taxes are estimated based on multiplying total personal income times 31 percent (share of taxable expenditures), times an average local sales tax rate of 2 percent, and a state rate of 6.1 percent. Indirect local sales tax revenues range from \$9,000 to \$16,000 per year for the solar plants and state sales taxes would range from \$27,000 to \$49,000 per year, depending on the size of the plant. For the RTAP transmission lines, the Delaney to Palo Verde project could generate an estimated \$500 in local sales tax revenues and \$1,500 in state sales tax revenues per year, while the Palo Verde to North Gila project could generate \$3,100 and \$9,400 in local and state sales taxes, respectively.

In terms of state personal income tax, direct and indirect employees associated with the transmission lines could generate approximately \$15,000 in revenues per year, while the solar plant employees could generate \$41,000 to \$81,000 per year. State income tax revenues are calculated using average income per employee and current tax schedules from the Arizona Department of Revenue.

In total, the RTAP transmission lines could generate approximately \$49,000 in new indirect state and local tax revenues per year and the solar plants would generate \$104,000 to \$202,000, depending on the size.

## 5.0 Conclusion

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The construction of renewable transmission lines and related solar PV plants and would generate sizeable local economic and revenue benefits to Arizona. Construction costs for these types of facilities are significant. Even though much of the equipment for solar PV plants is currently manufactured outside of the state, a large number of local workers would be involved in the process. These construction projects would also generate a large amount of construction sales tax revenues.

The proposed transmission line projects are also sizeable in terms of construction costs and may be able to rely more heavily on local suppliers. In addition they would generate a significant number of local construction jobs and a corresponding increase in consumer demand, potentially in rural areas of western Arizona, during the construction phase. The transmission line projects will also generate construction sales tax revenues for Maricopa County and the state.

Once construction is complete, the solar PV plants would employ a relatively small number of people, but the average salaries of these employees would be well above average industry wages in the state. The transmission lines would also generate a small number of permanent jobs to support on-going maintenance. The solar plants as well as the RTAP transmission lines would generate a significant increase in local property taxes to local governments and school district with minimal increases in residents and student population. The employees would also generate a small annual increase in local and state property, sales and income taxes. Overall, these facilities would not only increase the development of renewable energy resources in the state but they would create significant positive economic and revenue impacts on state and local governments.