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FROM: Paul Coomes

RE: Estimated economic and fiscal impacts of Madison County solar project

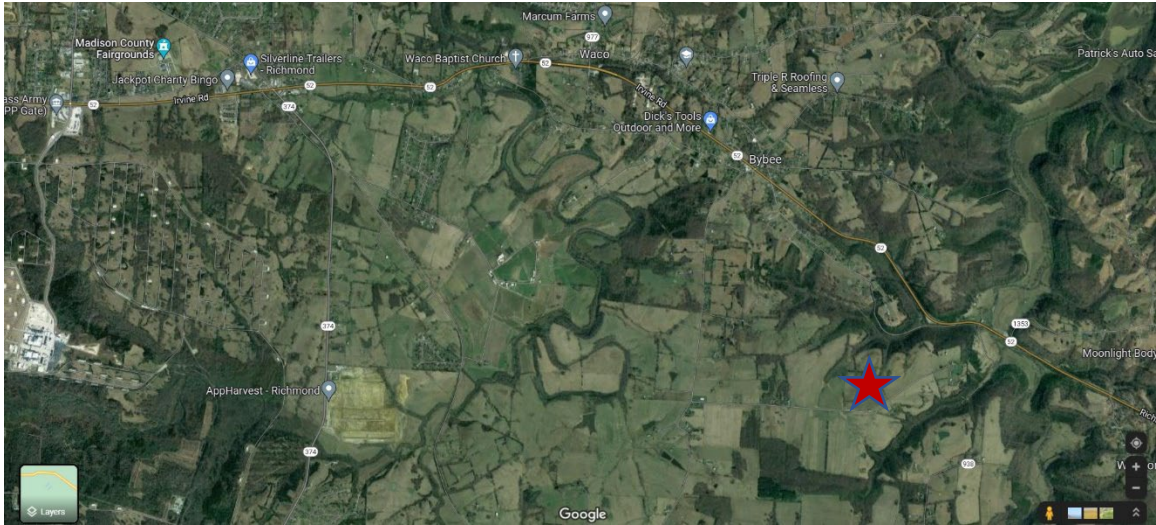
AES is developing a solar farm with 50 MW generating capacity on about 480 acres of rolling farmland east of Richmond, in Madison County KY. The company plans to invest approximately \$70 million to develop the site, named Pine Grove. This note provides estimates of the new local economic and fiscal activity expected from the development.

There are two primary impacts expected from the project. First, there will be a spike in construction and linked jobs as the site is built out over approximately one year, with a commensurate increase in County occupational tax receipts. Using estimates of the construction payroll, I estimate that there will be a total (direct and spinoff) of 165 new jobs in the County in year one, with new payroll of \$11.6 million. That payroll would yield \$116,000 in one-time occupational tax receipts for Madison County.

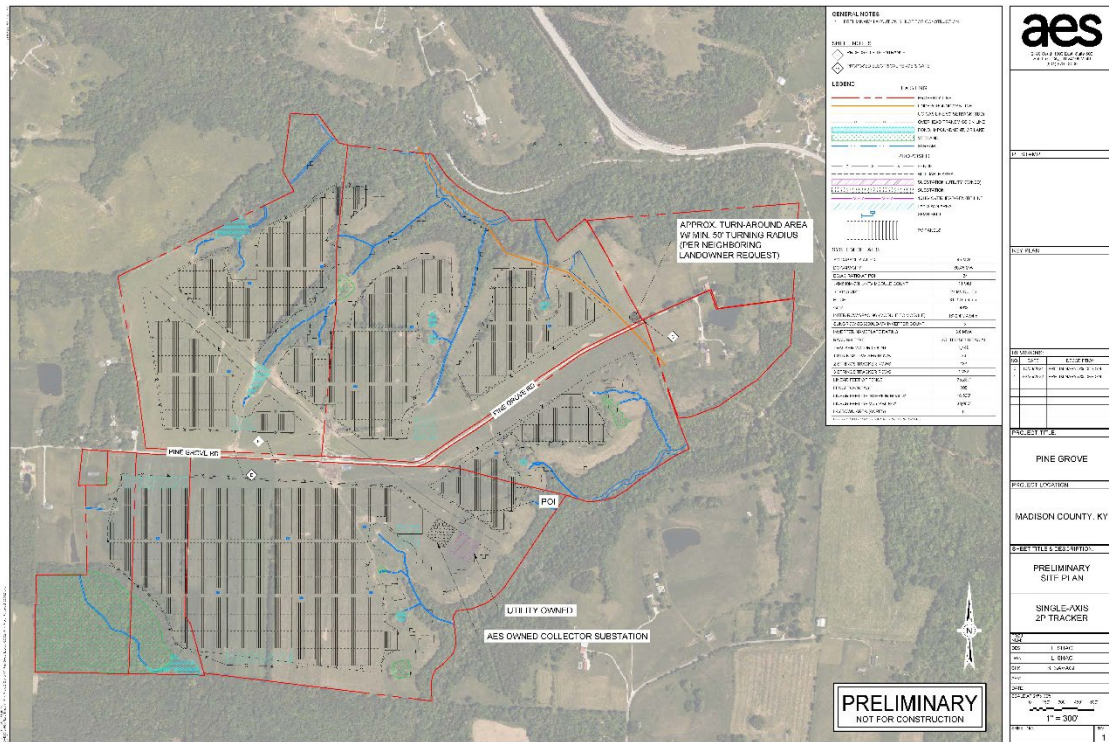
Second, there will be three to four decades of new property-related tax payments to state and local jurisdictions in Madison County due to the increased value of real estate, machinery and tangible property installed at the site. Over 35 years, this would lead to \$6.01 million in property tax revenues for local government jurisdictions in Madison County. The six land parcels involved generated \$2,100 in property taxes in 2021, almost all going to local jurisdictions. This can be compared to an average of \$172,000 likely to be generated per year by the solar project over the life of the project

Location

The site is on Pine Grove Road just east of Richmond, as indicated by the red star on the Google map of the area.



The next exhibit shows the site plan produced by the developing company.



Construction phase

The company expects to invest approximately \$70 million in the solar project. The investment involves land acquisition, site preparation, solar panel and electrical equipment installation, plus landscaping and security fencing. AES will hire construction companies for this project, so it is not possible to know precisely how many workers will be employed nor their total compensation. For modeling purposes, I am using an estimate of average employment over a one-year construction phase. Using the results of a recent California study of six large photovoltaic projects suggests that there will be an average of 120 direct jobs over a twelve-month construction period for this project¹.

Occupations include construction managers, earth grader operators, panel installers, electricians, and fencers. I searched the federal database on hundreds of occupations to learn how much these workers are likely to earn on the project. There is no listing in the Kentucky data for “Solar Photovoltaic Installer”, but the national average annual wage in 2021 was \$50,710².

Good inferences about other relevant occupations can be gleaned from the accompanying table. The construction managers are likely to earn over \$90,000, heavy equipment operators and installers over \$50,000, electricians around \$53,000, and fencers \$35,000. The company has a projected schedule of labor cost for construction,

Kentucky Wages for Related Occupations, 2021				
SOC code	Occupation	Employment	Hourly mean wage	Annual mean wage
11-9021	Construction Managers	980	\$46.54	\$96,800
47-2073	Operating Engineers and Other Construction Equipment Operators	5,930	\$24.80	\$51,580
47-2111	Electricians	9,260	\$25.66	\$53,370
47-4031	Fence Erectors	60	\$16.77	\$34,880
17-2112	Industrial Engineers	320	\$41.01	\$85,300
17-2131	Materials Engineers	2,370	\$45.47	\$94,570
17-2141	Mechanical Engineers	1,210	\$39.23	\$81,600
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	5,790	\$24.27	\$50,470
49-9051	Electrical Power-Line Installers and Repairers	2,930	\$32.41	\$67,410
49-9052	Telecommunications Line Installers and Repairers	1,170	\$23.25	\$48,350

Source: US Bureau of Labor Statistics, Occupational Employment Survey, www.bls.gov/oes/current/oes_ky.htm

¹ A University of California-Berkeley study looked at six large PV projects in California, and summarized the economics. The author finds a ratio of 2.4 FTE construction jobs per MW. Applied to Pine Grove’s 50 MW you get 120 direct construction jobs. He shows the permanent operations jobs per MW, and applied to this project you get about 1.6 FTEs. See page 28 of *Economic and Environmental Benefits of Building Solar in California*, by Peter Philips, November 10, 2014, <https://laborcenter.berkeley.edu/pdf/2014/building-solar-ca14.pdf>

² Source: US Bureau of Labor Statistics, Occupational Employment Survey. For national data on solar photovoltaic installer, see www.bls.gov/oes/current/oes_nat.htm#47-2231. For Kentucky data, see www.bls.gov/oes/current/oes_ky.htm. County-level data are not available.

with total expected wages and salaries of \$8.6 million, with additional fringe benefits of \$3.4 million. These projections suggest that average annual pay will be \$71,700 for construction jobs. The average annual pay for all jobs in Madison County in 2020 was \$42,363³. Multiplying the 120 jobs times the assumed average pay per job yields a direct construction payroll of \$8.6 million.

Spin-off impacts in Madison County

The construction phase will have some spin-off effects in Madison County. I model this using a custom IMPLAN model of the County⁴. The relevant sector for the construction phase is number 52, “Construction of new power and communication structures”, and this can be used to model the initial investment. The direct effect in the County is 120 jobs over one year, with a payroll of \$8.6 million.

The model has detailed information about the inter-industry linkages in each regional economy, as well as the expected household spending on retail goods and services due to the enhanced employee compensation. When there is new industrial activity in a region, the model can predict how much of the supply chain can be met by local businesses and how much the new payroll will result in additional sales (and jobs) by local businesses. Adding these two effects to the direct effect yields the total effect of a development, and dividing the total effect by the direct effect yields a multiplier. Using the Madison County multipliers for the relevant construction sector, and the direct construction budget, I project there will be a total of 165 new jobs in the County, and new payroll of \$11.6 million.

Regional impacts from construction

Some readers may wonder why I have focused on impacts in Madison County as opposed to more widespread regional impacts. Keep in mind that most federal-state statistical agencies and models measure employment on a place of work basis, as opposed to a place of residence basis. So, all construction workers at the site are counted as Madison County jobs. Nevertheless, clearly there will be some spinoff economic activity in surrounding counties, as supplies are purchased and workers spend their paychecks at retail establishments. One can see from the latest data on commuting patterns that 76 percent of workers in Madison County are also residents of Madison

³ Source: US Bureau of Economic Analysis, <https://www.bea.gov/data/by-place-county-metro-local> , Table CAINC30, average annual wages and salaries in county.

⁴ For documentation of IMPLAN modeling, see www.implan.com/history/ .

County. Fayette County also supplies a significant share of workers, as do contiguous counties Estill, Rockcastle, Jackson and Garrard.

On the other hand, nearly all working Madison County residents work in either Madison or Fayette counties, together accounting for 90 percent of the work destinations. Other less important destinations include Scott, Clark, Franklin and Laurel counties. See next table. Clearly, there is a strong commuter flow to Lexington and Georgetown, pulled north by the large number of high-paying jobs available up Interstate 75.

County of Residence of Workers in Madison County, Kentucky		
	Number	Share of Total
Madison County	27,748	76.2%
Fayette County	1,768	4.9%
Estill County	1,480	4.1%
Rockcastle County	1,306	3.6%
Jackson County	894	2.5%
Garrard County	806	2.2%
other counties	2,392	6.6%
Total workers	36,394	100.0%

Source: US Census Bureau, American Community Survey, Residence County to Workplace County Commuting Flows, 5-Year ACS, 2011-2015

County of Work for Madison County Residents, Kentucky		
	Number	Share of Total
Madison County	27,748	71.7%
Fayette County	6,903	17.8%
Scott County	808	2.1%
Clark County	468	1.2%
Franklin County	292	0.8%
Laurel County	287	0.7%
other counties	2,210	5.7%
Total workers	38,716	100.0%

Source: US Census Bureau, American Community Survey, Residence County to Workplace County Commuting Flows, 5-Year ACS, 2011-2015

To investigate possible broader regional impacts, I built another IMPLAN model, this time of Madison and the five counties supplying the most workers. The results are somewhat larger than that of the Madison-only simulation, primarily because of the inclusion of the much more populous Fayette County. It is only 27 miles between Richmond and Lexington on Interstate 75, and Fayette County supports a much more developed industrial and retail economy than Madison.

The job multipliers for the solar farm construction phase are 1.376 for Madison alone, and 1.569 for the six-county region, for a net change of 23 total predicted jobs. (Other economic multipliers, such as labor

income and business output, are also consistently in that range). I also performed a comparable simulation using a model covering the whole state of Kentucky. The job multiplier for the solar farm is 1.564, almost identical to that for the six-county region.

Based on our impact analysis tools, there are not significant differences in the predicted regional impacts when zooming out to adjacent counties or statewide⁵. In this case, the economic multipliers are relatively small whether one models one county, six, or 120. This is due to the lack of industrial linkages in the region to the solar industry.

Ongoing operations

There will also be some modest spin-off impacts from ongoing operations. The company expects operations to support one or two jobs. Unfortunately, for the operations phase, the relevant IMPLAN sector, number 42, “Electric Power Generation – Solar”, is empty of data and results for Madison County. This is because there is no history of solar electricity generation and therefore no basic economic data to construct industry relationships. (The sector is also empty of data for the statewide model, for the same reason). A reasonable recourse is to tap the literature on solar project impacts, find comparable places, and use other studies to estimate the likely operational impacts on local economies in Kentucky. The California PV study cited above found that a ratio of 31.3 MW per permanent operations job. Applied to the Madison County project, this results in an estimate of 1.4 permanent operational jobs at the site. Thus, ongoing annual economic impacts are expected to be very small relative to the one-time impacts of construction.

It is beyond the scope of this analysis to try to net out all the other economic impacts from the change in land use. Relevant negative factors include the loss of expected income from farming, and agriculture’s linkages to local suppliers of seed, feed, and other supplies. On the positive side are the large land payments going to the farm owners, the income to the one or two new operations jobs at the solar farm, plus the linkages of those income streams to the local economy. To measure all these would require some basic information about current farm activity, the amount of payments to farm owners.

Local tax revenues

Madison County and the Commonwealth of Kentucky levy property taxes on real estate and tangible property (and the Commonwealth taxes the value of manufacturing machinery). The table below provides the latest published tax rates that are applied County-wide. They total less than one percent of the assessed value of property. There

⁵ For other industrial developments around Kentucky it is common for our models to predict job multipliers of 3, 4, or 5, particularly for complicated manufacturing operations such as motor vehicles and parts.

are two municipal taxing jurisdictions in Madison County, Berea and Richmond, but the project is outside their city boundaries and thus would not be subject to those property taxes. Madison County levies a county-wide occupational license fee (payroll) and a net profits tax, both at a rate of 1.0 percent. Thus, assuming the above construction payroll is met, the County will receive about \$116,000 in occupational tax payments in year one.

Madison County Property Tax Rates, 2021		
in cents per \$100 valuation		
Jurisdiction	Real Estate	Tangible Personal
Extension Services	1.8000	3.3700
Fiscal Court - General	7.6000	9.5000
Health Department	5.0000	5.0000
Library	5.4000	7.3700
County Public Schools	62.8000	63.8000
EMS	4.6000	6.0000
Total, County-wide	87.2000	95.0400
Source: Kentucky Department of Revenue		
https://revenue.ky.gov/News/Publications/Pages/Property-Tax-Rate-Books.aspx		

The company has provided me with estimates of their intended investment, but not a projection of property tax payments. I have made estimates using current tax rates, and assuming a 5 percent annual depreciation rate for tangible property and manufacturers machinery. The company expects to invest \$3.8 million in real estate, \$46.4 million in tangible personal property, and \$4.4 million in manufacturing machinery. Over 35 years, this would lead to \$6.01 million in property tax revenues for local government jurisdictions in Madison County.

The company provided me with the parcel numbers of the land for the site, and I looked up their ownership, taxable value, and current property tax payments through the websites of the Madison County Property Valuation Assessor and Sheriff’s office. The six parcels have a combined taxable value of \$1.303 million, and generated \$2,100 in property taxes in 2021, almost all going to local jurisdictions. This can be compared to an average of \$172,000 generated by the solar project per year over the life of the project. It should be pointed out that solar projects like this require almost no public services from local government; and because they require so few people to operate do not add students and expenses to the County public school system.