

**UNDERTAKING J10.2**

**Undertaking**

LEI to provide summary statistic progression results, including T-statistic, R-squared and confidence level.

**Response**

**Reference:**

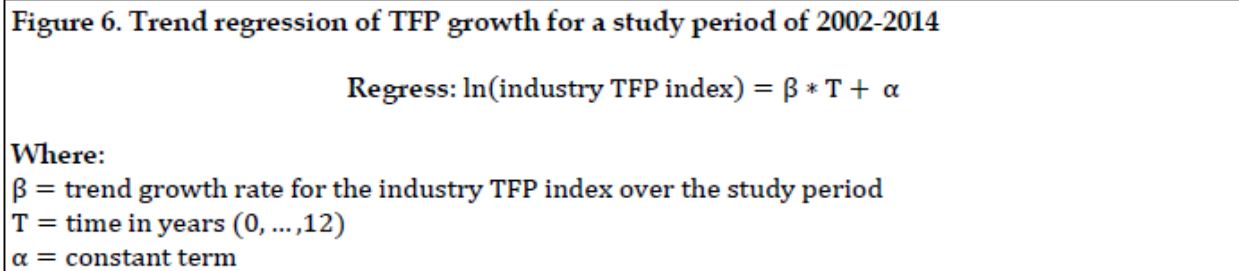
Ref: Exhibit L, Tab 11.1 Schedule 1 Staff-246

LEI performed a regression analysis to analyze whether a linear relationship exists between the industry average TFP growth rates and time. The following time series table is contained in LEI's work papers and was used to perform the TFP trend regression calculation.

| <b>T</b><br><i>(X variable)</i> | <b>Natural log of TFP</b><br><b>index values</b><br><i>(Y variable)</i> |
|---------------------------------|---|
| 0                               | 0.00  |
| 1                               | 0.07  |
| 2                               | 0.03  |
| 3                               | 0.04  |
| 4                               | 0.06  |
| 5                               | -0.11   |
| 6                               | -0.08   |
| 7                               | 0.02  |
| 8                               | -0.04   |
| 9                               | 0.04  |
| 10                              | -0.11   |
| 11                              | -0.09   |
| 12                              | -0.12   |

1 As outlined in Figure 6 on page 15 in LEI's 2016 TFP Study (which is reproduced below), the  
 2 equation was formulated to regress the annual industry TFP growth rates, in the form of natural  
 3 logarithm of the TFP index values (the Y variable), against the number of years of the study  
 4 period (the X variable). This trend regression approach is commonly used in business, finance  
 5 and economics to explore the change in the Y variable over time.<sup>1</sup> The estimated coefficient on  
 6 the X variable (number of years) is then the average TFP growth rate over the period being  
 7 examined. As noted in Section 6.2.2 of LEI's report, the purpose of the trend regression method  
 8 was to confirm, by another technique, the annual average TFP growth rate over the study  
 9 timeframe produced by the average growth method.

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The summary statistical outputs for the above equation are found in the tables below:

SUMMARY OUTPUT

| <i>Regression Statistics</i> |             |
|------------------------------|-------------|
| Multiple R                   | 0.645446573 |
| R Square                     | 0.416601278 |
| Adjusted R Square            | 0.363565031 |
| Standard Error               | 0.056587484 |
| Observations                 | 13          |

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ANOVA

|            | <i>df</i> | <i>SS</i>   | <i>MS</i>   | <i>F</i>    | <i>Significance F</i> |
|------------|-----------|-------------|-------------|-------------|-----------------------|
| Regression | 1         | 0.02515293  | 0.02515293  | 7.855029306 | 0.017192078           |
| Residual   | 11        | 0.035223577 | 0.003202143 |             |                       |
| Total      | 12        | 0.060376507 |             |             |                       |

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|                   | <i>Coefficients</i> | <i>Standard Error</i> | <i>t Stat</i> | <i>P-value</i> | <i>Lower 95%</i> | <i>Upper 95%</i> |
|-------------------|---------------------|-----------------------|---------------|----------------|------------------|------------------|
| Intercept         | 0.047100291         | 0.029659901           | 1.588012423   | 0.140590785    | -0.018180711     | 0.112381292      |
| T (time in years) | -0.011755973        | 0.004194543           | -2.80268252   | 0.017192078    | -0.020988101     | -0.002523846     |

<sup>1</sup> Diebold, Francis. *Econometrics - Streamlined, Applied and e-Aware*. March 2016.

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2 It is important to keep in mind that LEI's trend regression approach contrasts to the statistical  
3 analysis that Energy Probe attempted to present in Exhibit No. K9.3. Energy Probe is proposing  
4 to perform a hypothesis test, specifically a one sample  $t$  test, on the annual TFP growth rates.  
5 Energy Probe's use of LEI's sample data of TFP growth rates as their X variable (or as a  
6 "random variable" as suggested by Dr. Schwartz in hearings<sup>2</sup>) is problematic technically, as this  
7 data does not meet the necessary criteria discussed by LEI in Exhibit No. K9.2, OPG's response  
8 to Energy Probe Memorandum.  
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<sup>2</sup> Ontario Energy Board. *Transcript Oral Hearing OPG Volume 9 (p. 110-112)*. March 20, 2017.