Supplemental Material

Mapping Water Consumption for Energy Production Around the Pacific Rim

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Below are additional maps and tables supporting the paper “Mapping Water Consumption for Energy Production Around the Pacific Rim”. Maps include:

1. Water consumption for energy production:
   a. Thermoelectric power (Figure A1),
   b. Hydropower (Figure A2),
   c. Uranium extraction (Figure A3),
   d. Coal extraction (Figure A4),
   e. Oil extraction (Figure A5),
   f. Natural gas extraction (Figure A6),
   g. Unconventional oil and natural gas extraction (Figure A7),
   h. Oil refining (Figure A8),
   i. Biofuel refining (Figure A9), and
   j. Biofuel feedstock irrigation (Figure A10).

2. Total water consumption for energy production (Figure A11).

3. Water Risk (WRI 2015) (Figure A12)

4. Total water consumption mapped on water risk (Figure A13).

5. Total water consumption mapped on water risk centered on particular geographic regions:
   a. Australia and New Zealand (Figure A14),
   b. Brunei, Indonesia, Malaysia and Singapore (Figure A15),
   c. Canada (Figure A16),
   d. Chile and Peru (Figure A17),
   e. China and Hong Kong, China (Figure A18),
   f. Japan and Korea (Figure A19),
g. Mexico (Figure A20),
h. Papua New Guinea (Figure A21),
i. Philippines and Chinese Taipei (Figure A22),
j. Russia (Figure A23),
k. Thailand and Viet Nam (Figure A24),
l. United States (Figure A25).

6. Table of water consumption for energy production by APEC member economy (Table A1).
7. Map of total water consumption for energy production by APEC member economy (Figure A26).
8. Comparison of energy related water consumption with population and GDP by APEC member economy (Table A2).
Figure A.1: Water consumed by thermoelectric power generation in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A2: Water consumed in hydropower production in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A3: Water consumed for uranium extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A4: Water consumed for coal extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A.5: Water consumed oil extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A6: Water consumed for natural gas extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A7: Water consumed for unconventional oil and gas extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A8: Water consumed for oil refining in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A9: Water consumed for biofuel refining in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A10: Water consumed for biofuel feedstock irrigation in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A1: Total water consumed for energy production in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.
Figure A1: Water risk in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region. Data are reproduced from WRI (2015).
Figure A13: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]). Data are mapped for the 21-member economies of APEC for almost 12,000 watersheds across this region.
Figure A14: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for Australia and New Zealand.
Figure A15: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for Brunei, Indonesia, Malaysia and Singapore.
Figure A16: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for Canada.
Figure A1: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for Chile and Peru.
Figure A18: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for China and Hong Kong, China.
Figure A19: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for Japan and Korea.
Figure A20: Total water consumption for energy production (Figure A111) mapped over regional water risk (Figure A12 [WRI 2015]) for Mexico.
Figure A21: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for Papua New Guinea.
Figure A22: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for the Philippines and Chinese Taipei.
Figure A23: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for Russia.
Figure A24: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for Thailand and Viet Nam.
Figure A25: Total water consumption for energy production (Figure A11) mapped over regional water risk (Figure A12 [WRI 2015]) for the United States.
Table A1: Water consumption for energy production aggregated by APEC member economy. Water consumption values are in Mm$^3$/yr.

| APEC Economy     | Thermoelectric | Oil Refining | Bio Fuel Refining | Coal | Uranium | Oil Production | Gas Production | Unconventional Oil and Gas | Hydropower | Biofuel Feedstock | Irrigation | Total Water Consumption |
|------------------|----------------|--------------|-------------------|------|---------|----------------|----------------|-----------------------------|------------|-------------------|------------|-----------------------|
| Australia        | 459            | 38           | 1                 | 440  | 93      | 10             | 2              | 0                           | 446        | 10                | 1053       |
| Brunei           | 1              | 1            | 0                 | 0    | 0       | 0              | 0              | 0                           | 0          | 0                 | 0          |
| Canada           | 283            | 153          | 6                 | 70   | 164     | 96             | 2              | 995                         | 957        | 30                | 1798       |
| Chile            | 53             | 16           | 0                 | 1    | 0       | 1              | 0              | 0                           | 356        | 0                 | 71         |
| China            | 8286           | 802          | 9                 | 3810 | 13      | 650            | 14             | 28                          | 12627      | 146               | 13757      |
| Hong Kong, China | 10             | 0            | 0                 | 0    | 0       | 0              | 0              | 0                           | 0          | 0                 | 0          |
| Indonesia        | 253            | 86           | 2                 | 463  | 0       | 128            | 5              | 0                           | 283        | 1                 | 938        |
| Japan            | 593            | 120          | 0                 | 0    | 0       | 2              | 1              | 0                           | 2557       | 0                 | 716        |
| Korea            | 404            | 234          | 0                 | 2    | 0       | 0              | 0              | 0                           | 352        | 0                 | 641        |
| Malaysia         | 101            | 44           | 0                 | 3    | 0       | 0              | 0              | 0                           | 325        | 0                 | 148        |
| Mexico           | 143            | 119          | 0                 | 16   | 0       | 190            | 5              | 71                          | 679        | 1                 | 544        |
| New Zealand      | 38             | 11           | 0                 | 5    | 0       | 5              | 0              | 0                           | 309        | 0                 | 59         |
| Papua New Guinea | 5              | 2            | 0                 | 0    | 0       | 5              | 0              | 0                           | 8          | 0                 | 12         |
| Peru             | 11             | 14           | 0                 | 0    | 0       | 23             | 2              | 0                           | 191        | 18                | 69         |
| Philippines      | 58             | 20           | 0                 | 8    | 0       | 0              | 0              | 0                           | 186        | 1                 | 88         |
| Russia           | 1697           | 422          | 0                 | 370  | 63      | 1823           | 101            | 0                           | 2813       | 9                 | 4484       |
| Singapore        | 20             | 99           | 0                 | 0    | 0       | 0              | 0              | 0                           | 0          | 0                 | 119        |
| Chinese Taipei   | 254            | 91           | 0                 | 0    | 0       | 0              | 0              | 0                           | 597        | 0                 | 344        |
| Thailand         | 126            | 75           | 2                 | 19   | 0       | 27             | 0              | 0                           | 191        | 22                | 271        |
| United States    | 6249           | 1521         | 1                 | 934  | 29      | 717            | 89             | 4262                        | 4480       | 11                | 13814      |
| Viet Nam         | 103            | 10           | 0                 | 44   | 0       | 0              | 0              | 0                           | 819        | 2                 | 158        |
| **Total**        | **19040**      | **3869**     | **22**            | **6140** | **362** | **3677**       | **222**        | **5356**                    | **27359**  | **249**            | **38937**  |
Figure A26: Total water consumption for energy production mapped by APEC member economy.
Table A2: Comparison of energy related water consumption with population and GDP by APEC member economy.

| APEC Economy        | Energy Related Water Consumption per Capita (Mm3) | Population (M persons) | GDP (B$US) | Energy Related Water Consumption per Capita (m3/person) | Energy Related Water Consumption per Dollar GDP (Mm3/B$US) |
|---------------------|--------------------------------------------------|------------------------|------------|--------------------------------------------------------|--------------------------------------------------------|
| Australia           | 1053                                             | 23.47                  | 1,455      | 45                                                     | 0.72                                                   |
| Brunei              | 2                                                | 0.42                   | 17         | 4                                                      | 0.09                                                   |
| Canada              | 1798                                             | 35.54                  | 1,785      | 51                                                     | 1.01                                                   |
| Chile               | 71                                               | 17.76                  | 258        | 4                                                      | 0.28                                                   |
| China               | 13757                                            | 1,364.27               | 10,355     | 10                                                     | 1.33                                                   |
| Hong Kong, China    | 10                                               | 7.24                   | 291        | 1                                                      | 0.04                                                   |
| Indonesia           | 938                                              | 254.45                 | 889        | 4                                                      | 1.06                                                   |
| Japan               | 716                                              | 127.31                 | 4,601      | 6                                                      | 0.16                                                   |
| Korea               | 641                                              | 50.42                  | 1,410      | 13                                                     | 0.45                                                   |
| Malaysia            | 148                                              | 29.90                  | 338        | 5                                                      | 0.44                                                   |
| Mexico              | 544                                              | 125.38                 | 1,295      | 4                                                      | 0.42                                                   |
| New Zealand         | 59                                               | 4.51                   | 200        | 13                                                     | 0.29                                                   |
| Papua New Guinea    | 12                                               | 7.46                   | 17         | 2                                                      | 0.71                                                   |
| Peru                | 69                                               | 30.97                  | 203        | 2                                                      | 0.34                                                   |
| Philippines         | 88                                               | 99.14                  | 285        | 1                                                      | 0.31                                                   |
| Russia              | 4484                                             | 143.82                 | 1,861      | 31                                                     | 2.41                                                   |
| Singapore           | 119                                              | 5.47                   | 308        | 22                                                     | 0.39                                                   |
| Chinese Taipei      | 344                                              | 23.46                  | 530        | 15                                                     | 0.65                                                   |
| Thailand            | 271                                              | 67.72                  | 405        | 4                                                      | 0.67                                                   |
| United States       | 13814                                            | 318.86                 | 17,419     | 43                                                     | 0.79                                                   |
| Viet Nam            | 158                                              | 90.73                  | 186        | 2                                                      | 0.85                                                   |

* World Bank, 2014. World Development Indicators, Total Population, at: [http://data.worldbank.org/indicator/SP.POP.TOTL](http://data.worldbank.org/indicator/SP.POP.TOTL)

† World Bank, 2014. World Development Indicators, GDP ranking, at: [http://data.worldbank.org/data-catalog/GDP-ranking-table](http://data.worldbank.org/data-catalog/GDP-ranking-table)