

Table 3. Energy ratio of output to input for various energy sources.

| <u>Energy source</u> | <u>Energy ratio</u> |
|---|---------------------|
| <i>Nonrenewable fossil fuels</i> ^{vi} | |
| Oil & natural gas (US wellhead) | |
| Discoveries – 1940s | >100 |
| – 1970s | 8 |
| Production of earlier discoveries – 1970s | 20 |
| – 1980s | 10 |
| Coal – 1950 (US mine) | 80 |
| – 1970 (US mine or strip) | 30 |
| <i>Renewable fuels</i> | |
| Ethanol (grain, sugarcane, crop residues) ^{vi} | 0.7-1.8 |
| Methanol (tree plantation) ^{vi} | 2.6 |
| Vegetable oil (precursor to biodiesel) ^{vii} | 1.8-4.6 |
| Biomass tree crops (fertilized) ^{viii} | 6-13 |
| Biomass herbaceous crops (fertilized) ^{ix} | 11-12 |
| Biomass crop, then gasification ^{viii,x} | 2-5 |
| Anaerobic digester biogas (8 countries) ^{xi} | 1.5-3.1 |
| Solar flat-plate collectors (heat) ^{xii} | 2-5 |
| <i>Non-solar electricity production</i> ^{vi} | |
| Coal-fired, US average | 9 |
| Western surface coal – no scrubbers | 6 |
| – scrubbers | 2.5 |
| Natural gas-fired ^{xii} | 2.3 |
| Nuclear light-water reactor | 4 |
| <i>Solar-related electricity production</i> | |
| Photovoltaic arrays ^{vi} | 1.7-10 |
| Parabolic-thermal collectors ^{xiii} | 3-8 |
| Wind turbines ^{xiv,xv} | 3-18 |
| Conventional or small hydroelectric ^{xvi} | 10-12 |
| Biomass-fired (plus crop production) ^{viii,x,xvii} | 3.3-3.7 |
| With advanced cogeneration ^{viii,xviii} | 8-9 |
| <i>Energy conservation</i> | |
| Double-pane windows ^{xix} | 136 |
| Ceiling insulation ^{xix} | 61 |
| Passive solar housing ^{xii} | 10-25 |

Notes for Tables 1-3.

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