

Appendix 6: Food processing and food preparation

All energy is described in terms of process energy, no inclusion of conversion losses or production and delivery energy

1. Food Processing

Table 1.1: Energy use for baby food

| Product | Country | Source | Comment | Electricity, MJ/kg output | Natural gas, MJ/kg output | Diesel, MJ/kg output |
|--------------|---------|----------------------|---|---------------------------|---------------------------|----------------------|
| Carrot pureé | Sweden | Mattson, 1999, p. 45 | Data for 1996. From frozen carrot cubes | 1,51 | 11,16 | 0,014 |

Table 1.2: Energy use for bread making etc.

| Product | Country | Source | Comment | Electricity, MJ/kg output | Oil, MJ/kg output | Natural gas, MJ/kg output | Thermal energy, MJ/kg output | Energy, carrier unknown, MJ/kg output |
|-----------------|---------|--|---|---------------------------|-------------------|---------------------------|------------------------------|---------------------------------------|
| Baked goods | - | Pimentel, 1996, Table 15.1 | Ref. from 1977 | - | - | - | - | 6,22 |
| Baguette, large | Sweden | Skogaholms bröd, Blomkvist, pers. comm. 1999 | Bake-off in retailing, from 70 % baked products | 1,87 | - | - | - | - |
| Baguette, small | Sweden | Skogaholms bröd, Blomkvist, pers. comm. 1999 | Bake-off in retailing, from 70 % baked products | 1,22 | - | - | - | - |
| Bread | Sweden | Thompsson, 1999, p. 178 | Ref. from 1996 | 2,67 | - | - | - | - |
| Bread | Sweden | Thompsson, 1999, p. 178 | Ref. from 1998, industry 2 | 1,53 | - | - | - | - |
| Bread | Sweden | Thompsson, 1999, p. 178 | Ref. from 1979, small bakery | 2,84 | 2,73 | - | - | - |
| Bread | Sweden | Sundkvist, 1999, pers. comm. | Home baking | 3,06 | - | - | - | - |
| Bread | Sweden | Sundkvist, 1999, pers. comm. | Bakery B1 | - | - | - | 6,30 | - |

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Table 1.2: Energy use for bread etc. continued....

| | | | | | | | | |
|------------------------------|--------|--|---------------------|------|------|-----|------|------|
| Bread | Sweden | Sundkvist, 1999, pers. comm. | Bakery B2 | 4,56 | - | - | - | - |
| Bread | Sweden | Sundkvist, 1999, pers. comm. | Bakery B3 | 3,40 | - | - | - | - |
| Bread | Sweden | Sundkvist, 1999, pers. comm. | Bakery B4 | - | - | - | 4,52 | - |
| Bread | Sweden | Sundkvist, 1999, pers. comm. | Bakery B6 | 3,60 | - | - | - | - |
| Bread | Sweden | Andersson, 1998, p. 20 | Industrial bakery 1 | 0,27 | - | 2,5 | - | - |
| Bread | Sweden | Andersson, 1998, p. 21 | Industrial bakery 2 | 1,40 | 0,13 | - | - | - |
| Bread | Sweden | Andersson, 1998, p. 23 | Local bakery | 0,57 | 2,30 | - | - | - |
| Bread | Sweden | Andersson, 1998, p. 20 | Home baking | 2,50 | - | - | - | - |
| Bread | - | Beech, 1980, p. 296 | Home baking | 3–15 | - | - | - | - |
| Bread rolls | - | Singh, 1986, p. 44 | - | 0,20 | - | - | - | 1,58 |
| Bread, wheat-rye | - | Heiss, 1996, p. 176 | - | 3,78 | - | - | - | - |
| Bread, standard white sliced | - | Beech, 1980, p. 293 | - | 0,30 | - | - | - | 2,0 |
| Bread, whole wheat | - | Landbrot 1995 | - | 1,10 | 2,09 | - | - | - |
| Bread, plaited loaf | - | Heiss, 1996, p. 176 | - | 1,98 | - | - | - | - |
| Cake, sponge or sand | - | Heiss, 1996, p. 176 | - | 2,16 | - | - | - | - |
| Cinnamon rolls | Sweden | Skogaholms bröd, Blomkvist, pers. comm. 1999 | - | 0,63 | - | - | - | - |

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Table 1.2: Energy use for bread etc. continued....

| | | | | | | | | |
|-------------------------------------|-----|---------------------|---|-------|---|---|---|---|
| Cookies and crackers | USA | Singh, 1986, p. 45 | - | 0,2 | - | - | - | 1 |
| Cookies, hard and soft, gingerbread | - | Heiss, 1996, p. 176 | - | 2,5 | - | - | - | - |
| Crackers | - | Heiss, 1996, p. 176 | - | 3,6 | - | - | - | - |
| Knäckebread | - | Heiss, 1996, p. 176 | - | 14,90 | - | - | - | - |
| Pastries, small wheat | - | Heiss, 1996, p. 176 | - | 3,40 | - | - | - | - |
| Laugengebäck, Sticks, Bretzels | - | Heiss, 1996, p. 176 | - | 5,90 | - | - | - | - |
| Toast, wheat bread | - | Heiss, 1996, p. 176 | - | 2,00 | - | - | - | - |

Table 1.3: Energy use for breakfast cereals

| Product | Country | Source | Comment | Electricity, MJ/kg output | Fossil fuel, MJ/kg output | Energy, carrier unknown, MJ/kg output |
|-------------------|---------|----------------------------|---|---------------------------|---------------------------|---------------------------------------|
| Breakfast cereals | - | Pimentel, 1996, Table 15.1 | Ref. from 1977. Grinding, milling, wetting, drying, baking. | - | - | 66 |
| Breakfast cereals | - | Singh, 1986, p. 39 | From whole grain | 2 | 17 | - |
| Oat flakes | - | Heiss, 1996, p. 154 | - | 0,30 | 0,50 | - |

Table 1.4: Energy use for canning etc.

| Product and process | Country | Source | Comment | Electricity, MJ/kg output | Fossil fuel, MJ/kg output | Thermal energy MJ/kg output | Energy, carrier unknown, MJ/kg output |
|----------------------------------|---------|---------------------------------------|--|---------------------------|---------------------------|-----------------------------|---------------------------------------|
| Beef and pork | - | Singh, 1986, p. 25 | - | 0,10 | 8,10 | - | - |
| Food specialties, canned | - | Singh, 1986, p. 32 | - | 0,50 | 3,30 | - | - |
| Fruit and vegetables, canned | USA | Singh, 1986, p. 33 | Storage, preparation, processing, Freezing/sterilisation | 0,10 | - | - | 2,00 |
| Fruit and vegetables, canned | - | Pimentel, 1996, Table 15.1 | Ref. from 1977 | - | - | - | 2,41 |
| Fruit and vegetables, canned | USA | Singh, 1986, p. 33 | - | 0,15 | 2,54 | - | - |
| Marmelade | | Puskas, Sommer, 1998, p. 16, appendix | - | 0,49 | 2,01 | - | - |
| Meat, canned | - | Puskas, Sommer, 1998, p. 16, appendix | - | - | - | - | 5,20 |
| Meat balls, canned | Sweden | Lorentzon et al, 1997, p. 80 | Canned meat-balls industrially prepared, 470 g. | 5,00 | 20,00 | - | - |
| Tomato ketchup | Sweden | Andersson, 1999, p. 8, paper II | Fabrication of ketchup from tomato paste etc. | 0,38 | - | 1,7 | - |
| Tomato paste | Italy | Andersson, 1999, p. 8, paper II | Fabrication of tomato paste from fresh tomatoes | 0,38 | - | 5,90 | - |
| Tomato mark 3-times concentrated | - | Heiss, 1996, p. 201 | Fabrication of tomato paste from fresh tomatoes | 1,80 | 8,1 | - | - |
| Tomatoes, canned | - | Heiss, 1996, p. 198 | Peeled canned tomatoes | - | - | - | 1,3 |
| Spinach, canned | - | Heiss, 1996, p. 198 | - | - | - | - | 4,2 |

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Table 1.5: Energy use for chips

| Product | Country | Source | Comment | Electricity, MJ /kg output | Fossil fuel, MJ/kg output |
|--------------|---------|--------------------------------|---------|----------------------------|---------------------------|
| Potato chips | - | Puskas/Sommer, 1998, p. 33 | - | 1,0 | 15 |
| Potato chips | - | Puskas/Sommer, 1998, p. 33 | - | 0,9 | 13 |
| Potato chips | - | pers. comm. manufacturer, 1999 | - | 2,1 | 11 |

Table 1.6: Energy use for chocolate.

| Product | Country | Source | Comment | Electricity, MJ/kg output | Energy, carrier unknown, MJ/kg output |
|-----------|---------|--|--------------------------------------|---------------------------|---------------------------------------|
| Chocolate | - | Unilever, Chris Dutilh, pers. comm. 1998 | roasting, mixing, refining, conching | - | 12-17 |
| Chocolate | Sweden | Cloetta, pers. comm. 1998 | data for 1998, chocolate bar | 5,5 | 3,1 |

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Table 1.7: Energy use for coffee.

| Product | Country | Source | Comment | Electricity, MJ/kg output | Steam, MJ/kg output | Energy, carrier unknown, MJ/kg output |
|-----------------|---------|--------------------|--|---------------------------|---------------------|---------------------------------------|
| Coffee, instant | - | Singh, 1986, p. 65 | Ref. from 1980, roasting, grinding, extraction, concentration, drying, packaging, shipping | 2,4 | 9,9 | 38 |

Table 1.8: Energy use for dairy products

| Product | Country | Source | Comment | Electricity, MJ/kg output | Fossil fuel, MJ/kg output | Steam, MJ/kg output | Energy, carrier unknown, MJ/kg output |
|------------------------------|---------|------------------------------|------------------------------|---------------------------|---------------------------|---------------------|---------------------------------------|
| Butter | Norway | Hogaas Eide, 1998, p. 59 | data from 1996 | - | - | - | 2,47 |
| Cheese | USA | Singh 1986, p. 28 | Natural cheese | | | 2.37 | |
| Cheese | USA | Singh 1986, p. 28 | Processed cheese | | | 2.7 | |
| Cottage cheese | USA | Singh 1986, p. 31 | | 0.202 | | | 0.105 |
| Cream, fresh | Sweden | Lorentzon et al, 1997, p. 51 | Data for 1997 | 0,80 | - | - | - |
| Cream, for long-term storage | Sweden | Lorentzon et al, 1997, p. 57 | Data for 1997 | 1,00 | 0,18 | - | - |
| Milk | - | Pimentel, 1996, Table 15.1 | Ref. from 1977. | - | | - | 1,48 |
| Milk | - | Thompsson, 1999, p. 186 | Ref. from 1999 | 0,79 | - | - | - |
| Milk | - | --- | Ref. from 1997 | 2,60 | - | - | - |
| Milk | - | --- | Ref. from 1998, small dairy | 3,20 | - | - | - |
| Milk | - | --- | Ref. from 1998, medium dairy | 1,30 | - | - | - |

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Table 1.8: Energy use for dairy products, continued....

| | | | | | | | |
|------------------------|--------|--------------------------------|--|-------|------|------|--------|
| Milk | - | -..- | Ref. from 1998, large dairy | 0,55 | - | - | - |
| Milk | - | -..- | Ref. from 1988, modern plant, glass bottles | 0,52 | - | - | - |
| Milk | - | -..- | Ref. from 1988, modern plant, one way containers | 0,50 | - | - | - |
| Milk | Norway | Moller and Hogaas, 1997, p. 40 | - | 0,26 | 0,65 | - | - |
| Milk | Norway | Hogaas Eide, 1998, p. 49 | data from 1997, 3 dairies studied, lowest value | 0,27 | - | - | 0,25 |
| Milk | Norway | Hogaas Eide, 1998, p. 49 | data from 1997, 3 dairies studied, highest value | 0,43 | - | - | 2,69 |
| Milk | USA | Singh, 1986, p. 29 | - | 1,00 | - | 1,90 | - |
| Milk and cream | Norway | Hogaas Eide, 1998, p. 59 | data from 1996 | - | - | - | 0,73 |
| Milk powder | USA | Singh 1986, p. 29 | - | 1.164 | - | - | 14.946 |
| Condensed milk | USA | Singh 1986, p. 29 | - | 0.977 | - | - | 2.798 |
| Sour milk products | Norway | Hogaas Eide, 1998, p. 59 | data from 1996 | - | - | - | 0,75 |
| Youghurt in small tins | Norway | Hogaas Eide, 1998, p. 59 | data from 1996 | - | - | - | 4,46 |

Table 1.9: Energy use for drying per kg of water evaporated

| Product | Country | Source | Comment | Electricity, MJ/kg water evaporated | Oil, MJ/kg water evaporated | Oil, kg/kg water evaporated | Energy, carrier unknown, MJ /kg water evaporated |
|--|---------|----------------------------------|--|-------------------------------------|-----------------------------|-----------------------------|--|
| Theoretical value for evaporation of water | - | Pimentel, 1996, Table 15.1 | Ref. from 1974, real energy use 2-6 times higher | - | - | - | 2,60 |
| Cereals | Sweden | Sonesson, 1993, p. 39 | ref. from 1987 | - | - | 0,155 | - |
| Cereals | Sweden | Thomsson, 1999, p. 102 | Ref. from 1998, indirected heated dryers | 0,3 | 5,4 | - | - |
| --- | --- | --- | Ref. from 1987, directly heated dryers | 0,3 | 4,3 | - | - |
| Cereals | Sweden | Johansson, 1998, p. 21 | From 0,12-0,2 litres of oil/kg water evaporated | 0,9 | - | 0,13 | - |
| Peas | Sweden | Carlsson-Kanyama, 1998, p. 47 | Ref. from 1997 | - | 5,2 | - | - |
| Rape seed | Sweden | Mattson, 1999, p. 31 | Drying from 18 % to 7 % moisture content | - | - | 0,13 | - |
| Rape seed | Sweden | Hoveliuss, 1999, p. 7, paper II | Ref. from 1994 | - | 7,05 | - | - |
| Rape seed | Sweden | Hoveliuss, 1999, p. 2, paper III | Ref. from 1993 | - | - | 0,155 | - |
| Rape seed | Sweden | Sonesson, 1993, p. 24 | ref. from 1987 | - | - | 0,13 | - |

Table 1.10: Energy use for drying per unit dry crop

| Product | Country | Source | Comment | Electricity, MJ/kg output | Oil, MJ/kg output | Oil, kg/kg output | Steam, MJ/kg output | Energy, carrier unknown MJ/kg output |
|-------------------|---------|------------------------------------|--|---------------------------|-------------------|-------------------|---------------------|--------------------------------------|
| Beet pulp | Sweden | Cederberg, 1998, p. 31 | Ref. from 1997, drying from 80% to 10 % moisture content | - | - | - | - | 6,4 |
| Cereals | Sweden | Johansson, 1998, p. 21 | From 0,12-0,2 liters of oil | 0,09 | - | 0,01 | - | - |
| Grass and alalafa | Denmark | Weidema, 1995, p. 57 | Ref. from 1989 | - | 1,16 | - | - | - |
| Peas, fodder | Sweden | Olsson, 1998, p. 7 | - | - | - | 0,01 | - | - |
| Soy beans | Brasil | Cederberg, 1998, p. 26 | Ref. from 1994, drying from 17 % to 11 % water content | - | - | - | - | 0,47 |
| Food | - | Pimentel, 1996, Table 15.1 | Ref. from 1977 | - | - | - | - | 15 |
| Potato flakes | - | Pimentel, 1996, Table 15.1 | Ref. from 1986 | - | - | - | - | 31 |
| Potato flakes | Sweden | Procordia Foods, 1998, pers. comm. | Large modern factory | - | - | - | - | 18 |
| Potato flakes | - | Heiss, 1996, p. 280 | figure without packaging | 0,70 | - | - | 30 | - |
| Potato granules | - | Heiss, 1996, p. 240 | figure without packaging | 2 | - | - | 40 | - |
| Potato granules | - | Singh, 1986, p. 34 | figure without packaging | 2,4 | - | - | - | 23 |

Table 1.11: Energy use for freezing and cooling

| Product | Country | Source | Comment | Electricity, MJ/kg output | Steam, kg/kg output | Steam, MJ/kg output | Energy, carrier not known, MJ/kg output |
|----------------------|---------|---|--|---------------------------|---------------------|---------------------|---|
| Carrot cubes | Sweden | Mattson, 1999, p. | freezing and storage during 24 hours | 0,72 | - | - | - |
| Food, not specified | Sweden | Naturvårdsverket, 1997a, p. 97 | freezing | 0,32 | - | - | - |
| Food, not specified | - | Pimentel, 1996, Table 15.1 | freezing. Ref. from 1977 | - | - | - | 7,60 |
| Peas, green fresh | Sweden | Svenska Nestle, Ulf Olofsson, pers. comm. | cleaning, parboiling, freezing | 0,87 | 0,49 | - | - |
| Bread | Sweden | Andersson, 1998, p. 27 | freezing bread at home, ref. from 1977 | 0,30 | - | - | - |
| Vegetables and fruit | - | BELF, 1983, p. 12,17 | cleaning, preparing and freezing | 0,31 | - | 1,11 | - |

Table 1.12: Energy use for Ice cream

| Product | Country | Source | Comment | Electricity, MJ /kg output | Energy, carrier not known, MJ/kg output |
|-------------------------------|---------|----------------------------|----------------|----------------------------|---|
| Ice cream | - | Pimentel, 1996, Table 15.1 | Ref. from 1977 | - | 3,68 |
| Ice cream and frozen desserts | - | Singh, 1986, p. 5 | - | - | 2,20 |
| Ice cream | USA | Singh 1986, p. 30 | - | 4,48 | 2,617 |

Table 1.13: Energy use for juice

| Product | Country | Source | Comment | Electricity, MJ /kg output | Fossil fuel, MJ/kg output | Energy, carrier not known, MJ/kg output |
|--------------|---------|------------------------------|---|----------------------------|---------------------------|---|
| Orange juice | Sweden | Lorentzon et al, 1997, p. 62 | ready-to drink juice made from frozen concentrate, for storage in room temperature, | 0,25 | 0,9 | - |
| Juice | - | Singh, 1986, p. 36 | from fresh citrus fruit, canned and frozen product | - | - | 4,60 |

Table 1.14: Energy use for meat products

| Product | Country | Source | Comment | Electricity, MJ /kg output | Fossil fuel, MJ/kg output | Energy, carrier not known, MJ/kg output |
|---------|---------|--------------------|------------|----------------------------|---------------------------|---|
| Sausage | - | Singh, 1986, p. 25 | cooked | 1,18 | 3,33 | - |
| Sausage | - | Heiss, 1996, p. 60 | cooked | - | 36,00 | - |
| Sausage | - | Heiss, 1996, p. 60 | salami | - | 10,80 | - |
| Sausage | - | Heiss, 1996, p. 60 | not cooked | - | 3,90 | - |

Table 1.15: Energy use for milling and polishing

| Product | Country | Source | Comment | Electricity, MJ /kg output | Oil, MJ/kg output |
|-----------------|-------------|-------------------------------|---------------------------------------|----------------------------|-------------------|
| Rye flour | Denmark | Weidema, 1995, p. 126 | Ref. from 1986 | 0,26 | - |
| Flour | Sweden | Thompsson, 1999, p. 103 | - | 0,36 | - |
| Flour, wheat | Sweden | Sundkvist et al, 2000 | Ref. from 1996, small mill | 2,17 | - |
| Flour, wheat | Sweden | Sundkvist et al, 2000 | Ref. from 1996, small mill | 2,58 | - |
| Flour, wheat | Sweden | Sundkvist et al, 2000 | Ref. from 1996, small mill | 0,54 | - |
| Flour, wheat | Sweden | Sundkvist et al, 2000 | Ref. from 1996, large industrial mill | 0,33 | - |
| Flour, wheat | Sweden | Sundkvist et al, 2000 | Ref. from 1996, large industrial mill | 0,33 | - |
| Flour, wheat | Sweden | Sundkvist et al, 2000 | Ref. from 1996, large industrial mill | 0,54 | - |
| Flour, wheat | Sweden | Andersson et al, 1998, p. 19 | Ref. from 1997, industrial mill | 0,32 | - |
| Flour, wheat | Sweden | Andersson et al, 1998, p. 19 | Ref. from 1997, industrial mill | 0,42 | 0,03 |
| Flour, wheat | USA | Singh, 1986, p. 38 | Storage, preparation and processing | 1,41 | - |
| Flour, wheat | - | Heiss, 1996, p. 130 | - | 0,24 | - |
| Flour, wheat | - | BELF, 1983, p. | Soft wheat flour in combined mill | 0,31 | - |
| Peas, cleaning | Sweden | Carlsson-Kanyama, 1998, p. 48 | Ref. from 1997, industrial mill | 0,13 | - |
| Rice, polishing | Netherlands | Carlsson-Kanyama, 1998, p. 48 | Large modern rice mill | 0,02 | - |
| Rice, polishing | - | Singh, 1986, p. 40 | - | 0,23 | 0,12 |

Table 1.16: Energy use for oil extraction and refining

| Product | Country | Source | Comment | Electricity, MJ /kg input | Fossil fuel, MJ/kg input | Steam MJ/kg input | Energy, carrier not known, MJ/kg input |
|---------------------------|---------|---------------------------------------|----------------|---------------------------|--------------------------|-------------------|--|
| Rape seed, oil extraction | Sweden | Hovellius, 1999, p. 8 paper II | Ref. from 1994 | 0,38 | 0,03 | 1,04 | - |
| Rape seed, oil extraction | Sweden | Mattson, 1999, p. 42 | Ref. from 1996 | - | - | - | 1,30 |
| Rape seed, oil extraction | Sweden | Sonesson, 1993, p. 24, farm equipment | Ref. from 1992 | 0,28 | - | - | - |
| Rape seed, oil extraction | Sweden | Cederberg, 1998, p. 27 | Ref. from 1997 | - | - | - | 0,92 |
| Rape seed, oil extraction | Sweden | Carlsson-Kanyama, 1998, p. 48 | Ref. from 1997 | - | - | - | 0,90 |
| Palm oil, refining | Sweden | Mattson, 1999, p. 41 | Ref. from 1996 | - | - | - | 1,10 |
| Soy bean, oil extraction | - | Cederberg, 1998, p. 29 | Ref. from 1997 | 0,17 | - | 0,97 | - |
| Soy bean, oil extraction | Norway | Cederberg, 1998, p. 30 | Ref. from 1997 | 0,15 | - | 1,10 | - |

Table 1.17: Energy use for pasta

| Product | Country | Source | Comment | Electricity, MJ /kg output | Hot water, MJ/kg output | Steam, MJ/kg input | Energy, carrier not known, MJ/kg output |
|------------------------|---------|-------------------------------|--------------------|----------------------------|-------------------------|--------------------|---|
| Macaroni and spaghetti | USA | Singh, 1986, p. 67 | - | 0,70 | 1,70 | - | - |
| Pasta | - | Heiss, 1996, p. 165 | - | 0,10 | - | - | 0,70 |
| Pasta | Sweden | Kungsörnen, 1999, pers. comm. | Modern large plant | 0,94 | 0,90 | - | - |

Table 1.18: Energy use for peeling

| Product | Country | Source | Comment | Electricity, MJ /kg output |
|----------|---------|-------------------|--------------------|----------------------------|
| Potatoes | Sweden | Edsjö, 1995, p. 7 | Industrial peeling | 0,01 |

Table 1.19: Energy use for soft drinks, alcohol

| Product | Country | Source | Comment | Electricity, MJ /kg output | Fossil fuel, MJ/kg output | Energy, carrier not known, MJ/kg output |
|--------------------------|---------|--------------------------------|----------------|----------------------------|---------------------------|---|
| Soft drinks | - | Pimentel, 1996, Table 15.1 | Ref. from 1977 | - | - | 5,97 |
| Wine, brandy and spirits | - | Pimentel, 1996, Table 15.1 | Ref. from 1977 | - | - | 3,47 |
| Soft drinks | Sweden | Manufacturer, pers. comm. 1998 | Data for 1998 | 0,99 | 1,37 | - |

Table 1.20: Energy use for sugar and candy

| Product | Country | Source | Comment | Electricity, MJ /kg output | Fossil fuel, MJ/kg output | Energy, carrier not known, MJ/kg output |
|----------------|---------|-------------------------------|--|----------------------------|---------------------------|---|
| Beet sugar | Sweden | Cederberg, 1998, p. 31 | Ref. from 1995 | - | - | 5,30 |
| Beet sugar | - | Pimentel, 1996, Table 15.1 | from beets, 17 % sugar, ref. from 1977 | - | - | 24 |
| Cane sugar | - | Singh, 1986, p. 46 | from sugar cane | 0,36 | 26 | - |
| Cane sugar | - | Pimentel, 1996, Table 15.1 | from canes with 20 % sugar, ref. from 1977 | - | - | 14 |
| Sugar crystals | - | Singh, 1986, p. 47 | refined sugar from raw sugar | 0,21 | 4,9 | - |
| Hard candy | - | Singh, 1986, p. 49 | hard candy from raw sugar and corn syrup | 0,74 | 5,2 | - |
| Sugar crystals | - | Singh, 1986, p. 48 | refined sugar from beets | 0,06 | 2,3 | - |
| Candy | Sweden | Cloetta, personal comm., 1998 | sockerbitar | 1,08 | - | 5,04 |

2. Food preparation

Table 2.1: Energy use for food preparation: households

| Product and process | Country | Source | Comment | Electricity, MJ /kg output |
|----------------------|-------------|-------------------------------------|---|----------------------------|
| Beans, boiled | Sweden | Olsson, 1998, p. 10 | Brown beans, previously soaked | 5,5 |
| Beans, boiled | Sweden | Olsson, 1998, p. 10 | Soy beans, previously soaked | 3,7 |
| Carrot pureé, heated | Sweden | Mattsson, 1999, p. 50 | Carrot puree in glass jar heated in a micro-wave oven | 0,34 |
| Carrot pureé, heated | Sweden | Mattsson, 1999, p. 50 | Carrot puree in glass jar heated in a cooker | 1,6 |
| Cauliflower | Switzerland | BAK 1992, p. 141 | Cauliflower, 600g, prepared in microwave oven | 0,8 |
| Cauliflower | Switzerland | BAK 1992, p. 141 | Cauliflower, 600g, prepared in pressure cooker | 1,0 |
| Cauliflower | Switzerland | BAK 1992, p. 141 | Cauliflower, 600g, prepared in hot air oven | 7,0 |
| Ham, boiled | Denmark | Weidema, 1995, p. 69 | Ham prepared in oven | 4,9 |
| Ham, cooked | Sweden | Olsson, 1998, p. 10 | Ham prepared on a stove | 4,2 |
| Chicken, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Refrigerated chicken, 500 gr. prepared on stove | 2,9 |
| Chicken, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Refrigerated chicken, 500 gr. prepared in oven | 7,4 |
| Chicken, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Frozen chicken, 500 gr. prepared on stove | 3,3 |
| Chicken, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Frozen chicken, 500 gr., prepared in oven | 8,5 |
| Chicken, heated | Sweden | Johannisson och Olsson, 1997, p. 12 | Ready-grilled chicken 500 gr. heated in oven | 7,3 |
| Chicken, heated | Sweden | Johannisson och Olsson, 1997, p. 12 | Ready-grilled chicken 500 gr. heated in micro-wave oven | 0,67 |
| French fries, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Frozen french fries, 120 gr., prepared in oven | 7,7 |
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Frozen meatballs, 125 gr., fried on stove | 5,1 |
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Frozen meatballs, 125 gr, fried in oven | 22 |
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Frozen, industrially prepared, 125 gr., heated in micro-wave oven | 0,88 |
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Refrigerated, industrially prepared, 125 gr., fried on stove | 4,4 |
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Refrigerated, industrially prepared, 125 gr., fried in oven | 19 |
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Refrigerated, industrially prepared, 125 gr., heated in micro-wave oven | 0,74 |

Table 2.1: Energy use for food preparation: households, continued...

| | | | | |
|-------------------|-------------|-------------------------------------|---|-----|
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 12 | Home made meat balls, 125 gr., fried on stove | 4,9 |
| Peas, boiled | Sweden | Olsson, 1998, p. 10 | Yellow peas, previously soaked | 4,5 |
| Potatoes | Switzerland | BAK 1992, p. 141 | Potatoes, 600g, prepared in hot air oven | 6,0 |
| Potatoes | Switzerland | BAK 1992, p. 141 | Potatoes, 600g, prepared in pressure cooker | 1,3 |
| Potatoes | Switzerland | BAK 1992, p. 141 | Potatoes, 600g, prepared in microwave oven | 1,1 |
| Potatoes, boiled | Sweden | Johannisson och Olsson, 1997, p. 12 | Pealed potatoes, 300 gr. | 3,2 |
| Tenderloin | Switzerland | BAK 1992, p. 141 | Tenderloin, 350g, prepared in hot air oven | 8,0 |
| Tenderloin | Switzerland | BAK 1992, p. 141 | Tenderloin, 350g, prepared in microwave oven | 1,8 |

Table 2.2: Energy use for food preparation: restaurants and industries

| Product | Country | Source | Comment | Electricity, MJ /kg output | Fossil fuel, MJ/kg output | Energy, carrier not known, MJ/kg output | Other energy/unit of food |
|---------------------------------|---------|------------------------------------|--|----------------------------|---------------------------|---|--|
| Beans, boiled | Sweden | Olsson, 1998, p. 10 | Brown beans, previously soaked | 4,8 | - | - | - |
| Beans, boiled | Sweden | Olsson, 1998, p. 10 | Soy beans, previously soaked | 3,2 | - | - | - |
| Chicken, grilled | Sweden | Johannisson och Olsson, 1997, p. 9 | Grilling at a retailer | 2,0 | - | - | - |
| Chicken, blanching and cooling | Sweden | Johannisson och Olsson, 1997, p. 9 | From fresh chicken | 1,0 | - | - | - |
| Chicken, blanching and freezing | Sweden | Johannisson och Olsson, 1997, p. 9 | From fresh chicken | 1,5 | - | - | - |
| French fries | Sweden | Johannisson och Olsson, 1997, p. 9 | Industrially prepared. Incl. peeling, cooking, freezing and cold storage | 3,7 | - | - | - |
| French fries | - | Heiss, 1996, p. 240 | - | 9,0 | 8,3 | - | - |
| Ham, smoked | Denmark | Weidema, 1995, p. 130 | Smoking ham with maple syrup | 2,1 | - | - | 8,19 liter propane gas+0,03 kg fuel oil/kg input |
| Ham | - | Singh, 1986, p. 25 | - | 1,18 | 3,3 | - | - |
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 9 | Non-frozen meat-balls industrially prepared. Incl. cold storage, grinding, mixing, frying. | 2,9 | - | - | - |
| Meat balls, fried | Sweden | Johannisson och Olsson, 1997, p. 9 | Frozen meat-balls industrially prepared. Incl. cold storage, grinding, mixing, frying. | 3,2 | - | - | - |

Table 2.2: Energy use for food preparation: restaurants and industries, continued...

| | | | | | | | |
|--|--------|------------------------------------|--|------|-----|------|-----------------------------|
| Meat balls, fried | Sweden | Lorentzon et la, 1997, p. 63 | Non-frozen meat-balls industrially prepared. Incl. cold storage, grinding, mixing, frying packing. | 3,2 | 1,8 | - | - |
| Meat balls, fried | Sweden | Lorentzon et la, 1997, p. 71 | Frozen meat-balls industrially prepared, 1000g. Incl. cold storage, grinding, mixing, frying packing. | 3,4 | 1,8 | - | - |
| Meat balls, fried | Sweden | Lorentzon et la, 1997, p. 73 | Frozen meat-balls industrially prepared, 300 g. Incl. cold storage, grinding, mixing, frying packing. | 1,9 | 4,2 | - | - |
| Meat balls, fried | Sweden | Lorentzon et al, 1997, p. 80 | Canned meat-balls industrially prepared, 470 g. Incl. cold storage, grinding, mixing, frying, canning packing. | 5 | 20 | - | - |
| Meat, grinded | Sweden | Johannisson och Olsson, 1997, p. 9 | Grinded at a retailer | 0,30 | - | - | - |
| Peas, boiled | Sweden | Olsson, 1998, p. 10 | Yellow peas, previously soaked | 4 | - | - | - |
| Food, ready made | Sweden | Procordia Food, 1998, pers.comm. | Preparation and freezing, dish with meatballs | - | - | 5,26 | - |
| Food, not specified | Sweden | Naturvårdsverket, 1997a, p. 22 | Ref. from 1979, prepared in a restaurant | - | - | - | 9,72 MJ electricity/serving |
| Food, not specified, school kitchen | Sweden | Naturvårdsverket, 1997a, p. 22 | Ref. from 1979, pre-cooked food only | - | - | - | 1,08 MJ electricity/serving |
| Food, not specified, luxury restaurant | Sweden | Naturvårdsverket, 1997a, p. 22 | Ref. from 1979 | - | - | - | 25,2 MJ electricity/serving |
| Food, not specified, large restaurant | Sweden | Naturvårdsverket, 1997a, p. 22 | Ref. from 1995 | - | - | - | 3,24 MJ electricity/serving |
| Food, not specified, hospital kitchen | Sweden | Naturvårdsverket, 1997a, p. 22 | Ref. from 1995 | - | - | - | 1,44 MJ electricity/serving |

Table 2.3: Energy use for food preparation: theoretical values based on producer information about energy use for cooking appliances

| Cooking appliance and process | Source | Comment | Electricity, MJ /minute, minimum | Electricity, MJ /minute, maximum |
|----------------------------------|------------------------|------------------------------|-------------------------------------|-------------------------------------|
| Microwave, high speed warm up | Cited in Jungbluth1997 | Min./ max. 650W/800 W | 0,039 | 0,048 |
| Microwave, cooking | Cited in Jungbluth1997 | Min./ max.: 250 W / 700 W | 0,015 | 0,042 |
| Microwave, defrosting | Cited in Jungbluth1997 | Min./ max.: 150 W / 190 W | 0,009 | 0,011 |
| Microwave, warm keeping | Cited in Jungbluth1997 | Min./ max.: 80 W / 140 W | 0,005 | 0,008 |
| Electric, Stove (1 plate) | Cited in Jungbluth1997 | Min./ max.: 1000 W / 2800 W | 0,060 | 0,117 |
| Electric, oven | Cited in Jungbluth1997 | Min./ max.: 2200 W / 3900 W | 0,092 | 0,163 |
| Electric, oven (warmup+constant) | Cited in Jungbluth1997 | Min./ max.: 400 W / 1200 W | 0,024 | 0,072 |
| Gas, Stove (1plate) | Cited in Jungbluth1997 | Min./ max.: 1000 W / 2600 W | 0,060 | 0,108 |
| Gas, oven | Cited in Jungbluth1997 | Min./ max.: 1500 W / 2500 W | 0,090 | 0,150 |
| Wood, Stove & heating | Cited in Jungbluth1997 | Min./ max.: 5600 W / 15000 W | 0,336 | 0,900 |
| Wood, only use as stove | Cited in Jungbluth1997 | Min./ max. | 0,617 | 1,500 |
| Kerosene, stove | Cited in Jungbluth1997 | Min./ max.: 1000 W / 4000 W | 0,060 | 0,240 |

