furnaces were probably not considered in the 1993 CADDET study; however, the typical energy requirement of an aluminum reverberatory furnace is well within the ranges listed.

The energy efficiencies of best practice and typical melting furnaces discussed in Chapter 1, Section 2 are also listed in Table 25. This table calculates the delivered and tacit energy efficiencies. The steel arc furnaces are not listed because of insufficient information to accurately determine the chemical energy. The cupola-melting furnace data also includes coke efficiency, or the energy from coke, as compared to the iron energy requirement. Coke efficiency is often used to describe cupola operations.

Table 25 - Best Practice Melting Energy Efficiencies

Melt Method	Melt Energy 10^6 Btu/Ton	Tacit Melt Energy 10^6 Btu/Ton	Melt Energy Efficiency*	Coke Efficiency	Tacit Melt Energy Efficiency*
Iron Castings					
Heel Melting	3.31	10.39	36%		12%
Modern Batch Melting	1.84	5.77	65%		21%
Low-Efficiency Cupola	4.92	5.76	24%	36%	21%
High-Efficiency Cupola	3.25	3.84	37%	49%	31%
Aluminum Castings					
Gas Reverberatory Furnace	4.18	4.28	24%		23%
Gas Stack Melter	1.42	1.46	69%		68%

Note: Theoretical energy requirement; Iron = 1.200 Btu(10^6)/Ton, Aluminum = 0.986 Btu(10^6)/Ton.

***Efficiency calculations include all forms of energy used in the melting process and account for melt losses.**

The induction furnace energy efficiency is 36 to 65 percent delivered. However, the energy efficiency drops to 12 to 21 percent for tacit energy because of power generation and transmission losses. The cupola coke efficiency runs 36 percent for low efficiency operations and 49 percent for high efficiency cupolas. The total cupola energy efficiencies range between 24 and 37 percent and the tacit efficiencies range between 21 and 31 percent. The tacit energy differences for coke as a primary energy source do not deteriorate as much as in induction melting, which relies on electricity as a primary energy source. Aluminum melting reverberatory furnace efficiencies are 24 to 69 percent delivered, or 23 to 68 percent tacit efficiency. The natural gas used in aluminum melt furnaces has the best overall efficiency in a well run stack melter because it has very low tacit energy losses and an energy efficient design.

The best practice improvements described in Chapter 1, Section 2 are summarized in Table 26 to determine the kWh savings per ton of metal for all melting processes. The energy savings listed in Table 26 were used to generate the CO_2 and energy savings listed in Table 27. The CO_2 emissions factors discussed in the Introduction were applied to the different energy forms to determine the estimated CO_2 improvements corresponding to the energy improvements.