

**2012 Biennial Report to the Congress**  
**on the**  
**Current Status of Coin Production Costs**  
**and**  
**Analysis of Alternative Content**

**United States Mint**  
**Department of the Treasury**

**December 2012**

## **BACKGROUND**

The Coin Modernization, Oversight, and Continuity Act of 2010, Public Law 111-302 (Act) (Appendix 1) authorizes the Secretary of the Treasury (to conduct research and development (R&D) on alternative metallic materials for all circulating coins with the goal of reducing production costs. The Act also requires the Secretary to provide a biennial report to Congress on the current status of coin production costs and analysis of alternative content.

As required by section 3 of the Act, each biennial R&D report must address the following three areas:

- I. Production Cost Analysis: The Act requires the Secretary of the Treasury to analyze “production costs for each circulating coin, cost trends for such production, and possible new metallic materials or technologies for the production of circulating coins.”
- II. Recommendations for Changes to Coin Composition: The Act requires the Secretary to provide “detailed recommendations for any appropriate changes to the metallic content of circulating coins in such a form that the recommendations could be enacted into law as appropriate.”
- III. Recommendations for Changes to Coin Production: The Act requires the Secretary to provide “recommendations for changes in the methods of producing coins that would further reduce the costs to produce circulating coins, and include notes on the legislative changes that are necessary to achieve such goals.”

The United States Mint, a bureau of the Department of the Treasury, has conducted significant R&D since the law was enacted and has prepared this first biennial report to Congress.

## **SUMMARY**

As in 1965, when the United States last conducted significant research into alternative coin compositions, the Mint retained a third party metallurgical consultant to assist in the R&D and produce a study of many of the issues specified in the Act. Factors considered in assessing alternatives include the potential new coin’s color, wear resistance and lifespan, ability to be shaped and to hold an imprint, and acceptability to the vending industry and other stakeholders. Although the consultant’s study and additional R&D conducted to date has been thorough and meaningful, additional work is required before the Mint can make detailed recommendations for any specific changes in coin composition or methods of coin production.

## DISCUSSION

A summary of the Mint's progress in each of the mandated reporting areas are as follows:

### I. Production Cost Analysis:

a. *Production Costs for Each Circulating Coin.* The Mint ships circulating coins to Federal Reserve Banks (FRBs) in quantities ordered by the FRBs. The bureau bears all costs to mint and issue circulating coins. In exchange, the Mint receives face value payment (receipts) from the FRBs. The Mint's gross production costs are composed of "cost of goods sold" and "general and administrative" costs (G&A). The difference between the bureau's receipts and circulating coin production cost is called "seigniorage." The Mint maintains this accounting data and calculates financial results from circulating coinage operations, including the per-unit costs of minting and issuing U.S. coinage. Table 1 shows the number of coins delivered to the FRBs, the revenue received, the costs of production, and the G&A allocated for each denomination of U.S. coinage for each of the last three years.

TABLE 1 – Shipments, Costs, and Seigniorage by Denomination

SHIPMENTS, COSTS AND SEIGNIORAGE BY DENOMINATION  
(coins and dollars in millions except seigniorage per \$1 issued)

	One-Cent	Five-Cent	Dime	Quarter-Dollar	Half-Dollar	Dollar	Mutilated & Other	Total
2012								
Coins Shipments	5,835	1,006	1,658	486	-	97		9,082
Value of Shipments	\$ 58.4	\$ 50.3	\$ 165.8	\$ 121.7	\$ -	\$ 97.1	\$ -	\$ 493.3
Gross Cost	\$ 116.4	\$ 101.5	\$ 82.7	\$ 54.9	\$ -	\$ 20.5	\$ 11.4	\$ 387.4
Cost of Goods Sold	\$ 96.5	\$ 84.1	\$ 69.5	\$ 46.6	\$ -	\$ 17.7	\$ 11.4	\$ 325.8
General & Administrative	\$ 19.9	\$ 17.4	\$ 13.2	\$ 8.3	\$ -	\$ 2.8	\$ -	\$ 61.6
Seigniorage	\$ (58.0)	\$ (51.2)	\$ 83.1	\$ 66.8	\$ -	\$ 76.6	\$ (11.4)	\$ 105.9
Seigniorage per \$1 Issued	\$ (0.99)	\$ (1.02)	\$ 0.50	\$ 0.55	\$ -	\$ 0.79	\$ -	\$ 0.21
2011								
Coins Shipments	4,289	914	1,403	323	-	467		7,396
Value of Shipments	\$ 42.9	\$ 45.7	\$ 140.3	\$ 81.0	\$ -	\$ 467.0	\$ -	\$ 776.9
Gross Cost	\$ 103.1	\$ 102.2	\$ 79.3	\$ 36.0	\$ -	\$ 84.2	\$ 23.3	\$ 428.1
Cost of Goods Sold	\$ 85.4	\$ 86.1	\$ 67.1	\$ 30.3	\$ -	\$ 72.5	\$ 23.3	\$ 364.7
General & Administrative	\$ 17.7	\$ 16.1	\$ 12.2	\$ 5.7	\$ -	\$ 11.7	\$ -	\$ 63.4
Seigniorage	\$ (60.2)	\$ (56.5)	\$ 61.0	\$ 45.0	\$ -	\$ 382.8	\$ (23.3)	\$ 348.8
Seigniorage per \$1 Issued	\$ (1.40)	\$ (1.24)	\$ 0.43	\$ 0.56	\$ -	\$ 0.82	\$ -	\$ 0.45
2010								
Coins Shipments	3,487	359	887	252	-	414		5,399
Value of Shipments	\$ 34.9	\$ 17.9	\$ 88.7	\$ 63.2	\$ -	\$ 413.5	\$ -	\$ 618.2
Gross Cost	\$ 62.3	\$ 33.1	\$ 50.6	\$ 32.2	\$ 0.1	\$ 130.7	\$ 8.4	\$ 317.4
Cost of Goods Sold	\$ 62.3	\$ 33.1	\$ 40.8	\$ 24.6	\$ 0.1	\$ 69.9	\$ 8.4	\$ 239.2
General & Administrative	\$ -	\$ -	\$ 9.8	\$ 7.6	\$ -	\$ 60.8	\$ -	\$ 78.2
Seigniorage	\$ (27.4)	\$ (15.2)	\$ 38.1	\$ 31.0	\$ (0.1)	\$ 282.8	\$ (8.4)	\$ 300.8
Seigniorage per \$1 Issued	\$ (0.79)	\$ (0.85)	\$ 0.43	\$ 0.49	\$ -	\$ 0.68	\$ -	\$ 0.49

*Cost of Goods Sold includes the cost of materials (the cost of metal plus a fabrication fee paid to the supplier to process the metal into the shape required by the Mint) plus Mint direct and indirect production and distribution costs. G&A expenses are required operational expenses of the bureau not tied to the generation of a finished good.*

b. *Cost Trends for Circulating Coin Production.* Table 2 shows the detailed cost per unit to produce each denomination of U.S. coinage for each of the last three years. The data shows, for each denomination, the metal costs (metal plus a fabrication fee paid to the supplier), production costs (direct and indirect plant costs), G&A, and a distribution fee paid to deliver the coin to the FRBs.

TABLE 2 – Unit Cost<sup>1</sup> of Producing and Distributing Coins by Denomination

UNIT COST OF PRODUCING AND DISTRIBUTING COINS BY DENOMINATION						
2012	One-Cent	Five-Cent	Dime	Quarter-Dollar	Half-Dollar	\$1
Metal	\$0.0093	\$0.0611	\$0.0279	\$0.0674	\$ -	\$0.1275
Mint Production	\$0.0070	\$0.0218	\$0.0136	\$0.0269	\$ -	\$0.0527
General & Administrative	\$0.0034	\$0.0173	\$0.0080	\$0.0171	\$ -	\$0.0288
Distribution to FRB	\$0.0003	\$0.0007	\$0.0004	\$0.0016	\$ -	\$0.0021
<b>Total Unit Cost</b>	<b>\$0.0200</b>	<b>\$0.1009</b>	<b>\$0.0499</b>	<b>\$0.1130</b>	<b>\$ -</b>	<b>\$0.2111</b>

UNIT COST OF PRODUCING AND DISTRIBUTING COINS						
2011	One-Cent	Five-Cent	Dime	Quarter-Dollar	Half-Dollar	\$1
Metal	\$0.0117	\$0.0782	\$0.0315	\$0.0797	\$ -	\$0.1121
Mint Production	\$0.0080	\$0.0156	\$0.0159	\$0.0126	\$ -	\$0.0410
General & Administrative	\$0.0041	\$0.0176	\$0.0087	\$0.0176	\$ -	\$0.0251
Distribution to FRB	\$0.0003	\$0.0004	\$0.0004	\$0.0015	\$ -	\$0.0021
<b>Total Unit Cost</b>	<b>\$0.0241</b>	<b>\$0.1118</b>	<b>\$0.0565</b>	<b>\$0.1114</b>	<b>\$ -</b>	<b>\$0.1803</b>

UNIT COST OF PRODUCING AND DISTRIBUTING COINS						
2010	One-Cent	Five-Cent	Dime	Quarter-Dollar	Half-Dollar	\$1
Metal	\$0.0100	\$0.0641	\$0.0263	\$0.0647	\$ -	\$0.0933
Mint Production	\$0.0076	\$0.0275	\$0.0191	\$0.0309	\$ -	\$0.0726
General & Administrative	\$ -	\$ -	\$0.0110	\$0.0302	\$ -	\$0.1469
Distribution to FRB	\$0.0003	\$0.0006	\$0.0005	\$0.0020	\$ -	\$0.0029
<b>Total Unit Cost</b>	<b>\$0.0179</b>	<b>\$0.0922</b>	<b>\$0.0569</b>	<b>\$0.1278</b>	<b>\$ -</b>	<b>\$0.3157</b>

<sup>1</sup> Total unit cost is the sum of the component unit costs. Due to the rounding of some of the component costs, the total unit cost may not appear to precisely equal the sum of the relevant component costs from Table 1.

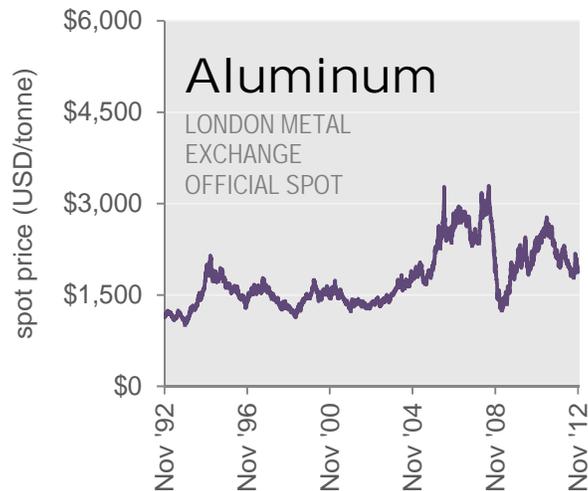
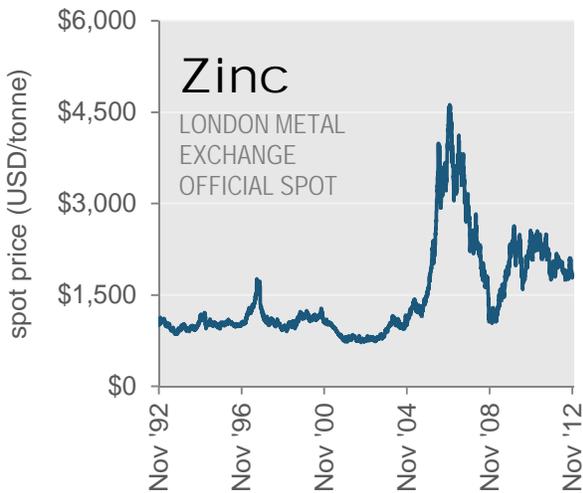
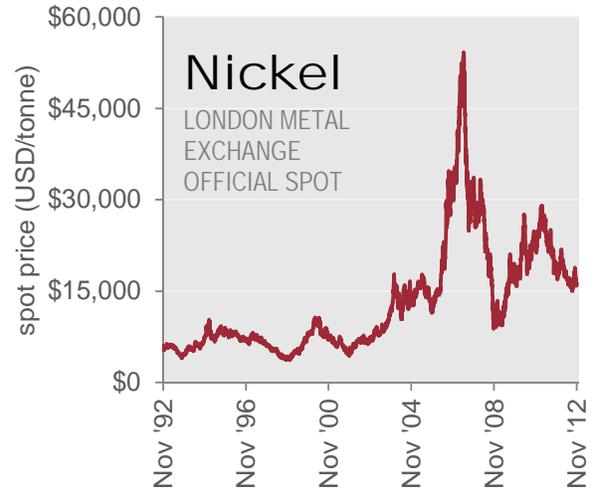
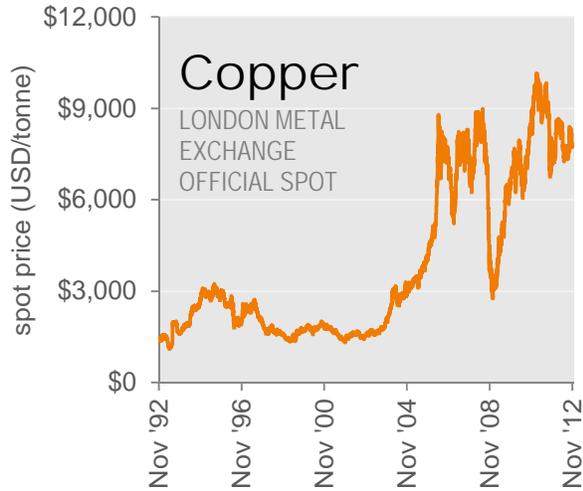
Table 3 shows key parameters for current circulating coin denominations. Composition, weight, and diameter are in some cases specified by statute.

TABLE 3: Metal and Other Specifications by Denomination<sup>2</sup>

Denomination	One-Cent	5-Cent	Dime	Quarter Dollar	Half Dollar	Dollar (Presidential \$1 Native American \$1)
<b>Bulk Composition</b>	Copper Plated Zinc	Monolithic Cupronickel	Cupronickel-Clad Copper	Cupronickel-Clad Copper	Cupronickel-Clad Copper	Clad Manganese-Brass
<b>Contents / Weight Percent [%]</b>	97.5% Zn-2.5% Cu	75% Cu-25% Ni	91.67% Cu-8.33% Ni	91.67% Cu-8.33% Ni	91.67% Cu-8.33% Ni	88.5% Cu-6% Zn-3.5% Mn-2% Ni
<b>Core</b>	A190 Zn	N/A	C110 Cu	C110 Cu	C110 Cu	C110 Cu
<b>Surface</b>	8 micron plated Cu	N/A	0.175 mm 75Cu-25Ni	0.226 mm 75Cu-25Ni	0.289 mm 75Cu-25Ni	0.413 mm Cu-12Zn-7Mn-4Ni
<b>Weight</b>	2.500 g	5.000 g	2.268 g	5.670 g	11.340 g	8.1 g
<b>Diameter</b>	0.750 in	0.835 in	0.705 in	0.955 in	1.205 in	1.043 in
	19.05 mm	21.21 mm	17.91 mm	24.26 mm	30.61 mm	26.49 mm
<b>Thickness</b>	1.55 mm	1.95 mm	1.35 mm	1.75 mm	2.15 mm	2.00 mm
<b>Edge</b>	Plain	Plain	Reeded	Reeded	Reeded	Edge Lettering
<b>No. of Reeds</b>	N/A	N/A	118	119	150	N/A

<sup>2</sup> The compositions of the current half-dollar, quarter-dollar, dime, 5-cent, and one-cent coins originally were specified in the Coinage Act of 1965, Public Law 89-91 (July 23, 1965), as amended by Public Law 93-441 (Oct. 11, 1974). The 1974 amendment, which gave the Secretary authority to vary the copper and zinc alloy comprising the one-cent coin, resulted in the change in 1983 from one-cent coins that were composed of 95 percent copper to the current composition of one-cent coins that are predominantly zinc, with a copper-plated surface. The Secretary has the discretion to select the composition of the dollar coin as long as it has “similar metallic, anti-counterfeiting properties as United States coinage in circulation” in 1997. 31 U.S.C. § 5112(b).

Zinc, copper, and nickel are the predominant metals used in current United States circulating coinage. The cost trends of zinc, copper, nickel, as well as steel and aluminum, over the last 20 years are provided in the following five graphs.



*c. Possible New Metallic Materials or Technologies for the Production of Circulating Coins.*

Soon after the Act was signed into law in December of 2010, the Mint contracted the services of Concurrent Technologies Corporation (CTC) to commence R&D on metallic materials for circulating coins and to prepare the background information, analysis, and supporting data necessary for the Department of the Treasury to submit its first biennial report under the Act. CTC completed the study in August 2012, and it is attached as Appendix 2 to this report. The study reflects the conclusions of CTC, based upon the scope of the work they performed. The Mint continues to do additional analysis.

The CTC report details relevant background information and the comprehensive R&D efforts that have been completed since December of 2010. Highlights include:

1. The Mint constructed a dedicated R&D laboratory within the Mint at Philadelphia and conducted two series of test strikes and evaluations on 29 different formulations. The evaluations consisted of tests for hardness, ductility, weight, color, surface finish, coinability (ability to be struck into a coin), corrosion and wear resistance, electro-magnetic signature, supply chain availability, and cost.
2. CTC and the Mint conducted significant outreach to the public and other key stakeholders including the vending industry, the commercial coin processing equipment industry, laundromat operators, car wash operators, the armored car industry, the public transportation sector, the FRBs, and current coin material suppliers. Size, weight, and electromagnetic signature of the metallic coin alternatives were the principal attributes of concern for these stakeholders.
3. The vending machine industry estimates that the best and worst case cost scenarios to modify the vending machines in the United States to accept coins of the same size and similar weight as existing coinage but with a different electro-magnetic signature would be between \$700 million and \$3.5 billion, assuming a one-time, standalone, universal upgrade. CTC's analysis includes consideration of the refresh and maintenance cycles of existing vending machines and places the conversion estimate at between \$380 to \$630 million.
4. Of the 80 metals on the periodic table of the elements, only aluminum, iron (used to manufacture steel), zinc, and lead cost less than the metals currently used in circulating coinage. For this reason, CTC and the Mint focused the alternative metals research on commercially available formulations of alloys and plated metals that use aluminum, steel, zinc, copper, and nickel.
5. When attempting to emulate current circulating coin attributes with those of potential new metallic alternatives, the electromagnetic signature was found to be the most difficult attribute to duplicate. With the exception of the one-cent coin, all current U.S. circulating coinage demonstrates the electromagnetic properties of copper.

6. At present, changes to the metals formulation of the one-cent coin would not yield significant cost improvements over the current formulation because the current market price of zinc is competitive with the prices of the credible alternatives, steel and aluminum.
7. For all denominations other than the one-cent coin, the current electromagnetic signature could be maintained with a slight reduction in nickel content, generating minimal cost reductions. Changing the electromagnetic signature potentially enables additional cost reductions that need to be confirmed with further research.
8. Additional production scale testing is required to confirm preliminary cost estimates of all the alternatives tested, including those which may not match the electromagnetic signature of existing coins.
9. Benchmarking against other global economies shows that providing industry with significant advance notice (two to three years) is a best practice before changing the metallic composition of circulating coins.
10. The Mint currently employs state-of-the-art coin manufacturing equipment and operates using similar production processes as other large, world-class mints around the world.

## II. Recommendations for Changes to Coin Composition:

As we believe the CTC report makes clear, the Mint must perform additional work before it has sufficient information to recommend possible new metallic materials or technologies for the production of circulating coins. Among other things, the Mint needs to (1) conduct production-scale tests with multiple lots of proposed coin materials to verify the potential supply chains and the results from the preliminary tests described in the CTC study, and (2) further research estimated stakeholder costs associated with a change in electromagnetic signature. As a result, the Department of the Treasury recommends that the Mint continue to study the issue before endorsing any specific changes to coin composition.

## III. Recommendations for Changes to Coin Production:

For the same reasons as stated in section II, above, the Department of the Treasury recommends that the Mint continue to study the issue before endorsing any specific changes to coin production.

## ATTACHMENTS

Appendix 1: Public Law 111-302 – Coin Modernization, Oversight, and Continuity Act of 2010  
Appendix 2: CTC Alternative Metals Study