



High Efficiency Cookware Study: Energy Usage Comparison of Stovetop and Insulated Cookware

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Introduction

This study examines the energy usage of five different technologies of cookware. Three insulated; a Crock-Pot model SCR200-R 2-QT slow cooker, a COSORI C3120-PC 2-QT pressure cooker and a Redmond 5-QT electric pressure cooker and two non-insulated; a SUNAVO 1500W electric cooktop, a Avantco IC1800 countertop induction range and an Air Core 8-quart insulated pot on the SUNAVO 1500W electric cooktop. Two different pressure cookers were used to see if volume influences cooking efficiency.







Methods and Materials

The standard cooking element used for each type of cookware was chickpeas. One cup of dried chickpeas soaked for 9 hours, and drained. It was then added to the cookware with 4 cups of room temperature water. The standard for doneness was set by the internal color gradient of the chickpea while cooking. The chickpea is considered done to standard when all of the creamy yellow color is gone all the way through. A chickpea is over done if it loses its structural integrity.



Figure 1: Chickpea cooking color gradient from right (uncooked) to left (fully cooked).

For both stovetop methods the pot of water was brought to a boil then left to simmer until the chickpeas cooked to the required texture. A P3 P4400 Kill A Watt Electricity Usage Monitor was used to measure energy use. A total of 13 tests were performed, three tests for each cookware type. For each test, energy use, time of the test, material volume and vessel volume were recorded. Two sizes of pressure cookers were used to test if the size of the cookware had an impact on cooking time or energy use. For the test of the cooktop and induction range, a stainless steel pot with a magnetic steel bottom was used. The insulated pot test used the Air Core insulated pot heated on the SUNAVO cooktop.

P3 P4400 Kill A Watt Electricity Usage Monitor	Crock-Pot model SCR200-R 2-QT slow cooker	COSORI C3120-PC 2-QT pressure cooker	Redmond 5-QT pressure cooker	SUNAVO 1500W electric resistance cooktop	Avantco IC1800 countertop induction range	Air Core 8 quart insulated pot
						

Results

The insulated cookware, pressure cookers and slow cookers used the least amount of energy per cup of cooking material. It was determined that the volume of the cookware did not significantly impact the efficiency. The induction stove proved on average to be more efficient than the electric cooktop. The induction was about 40 minutes faster and used 22% less energy than the electric resistance cooktop. The electric cooktop used the most energy but when paired with an insulated pot the energy usage decreased by about 38%, making its energy consumption 48% less than the induction stove top. On average the slow cooker took 2 hours and 28 minutes longer but only used 10.5% more energy than the 5 QT pressure cooker. The largest disparity was between the 5 QT pressure cooker and the electric cooktop. On average the 5 QT pressure cooker used only 20% of the energy that was need for the electric cooktop and was 1 hour and 34 minutes faster in cooking time.

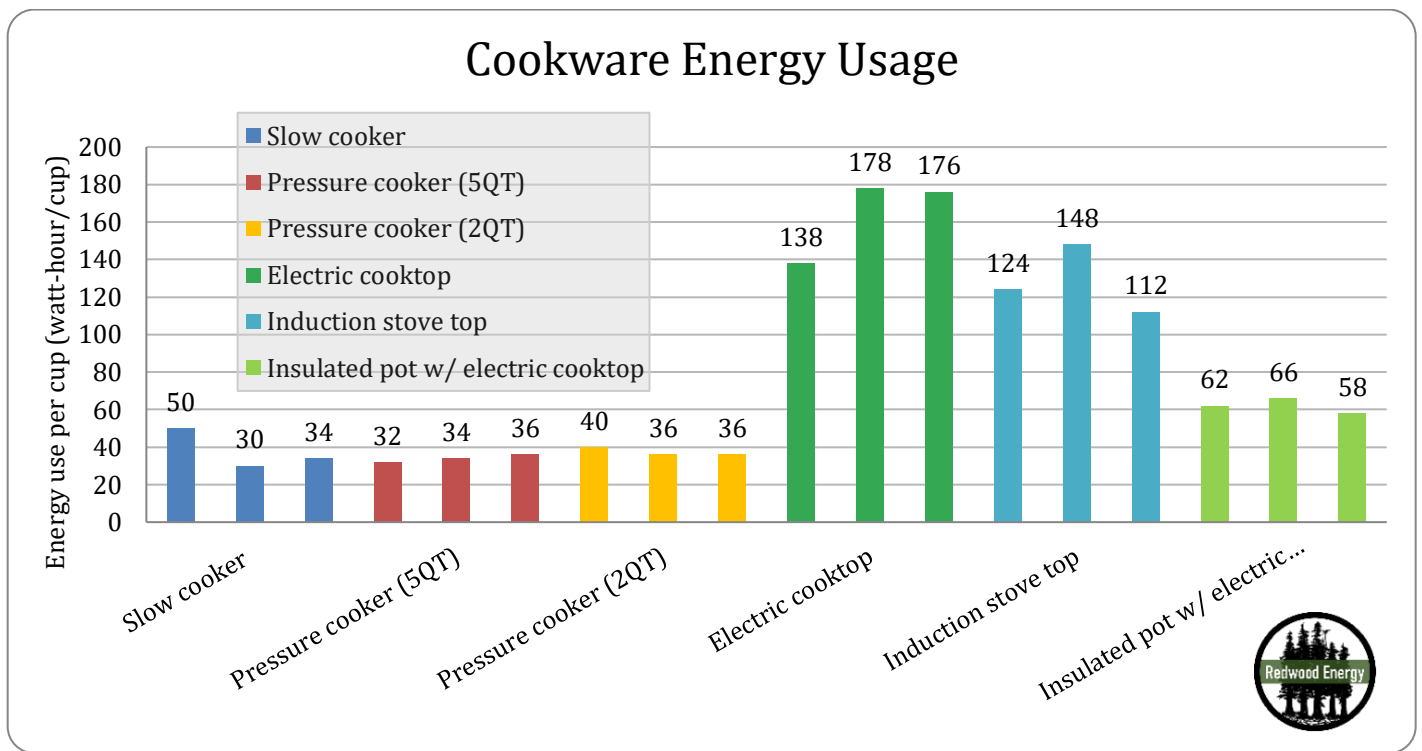


Figure 2: Watt-hours used per cup of cooking material for each of the five cooking vessels; three trials each.

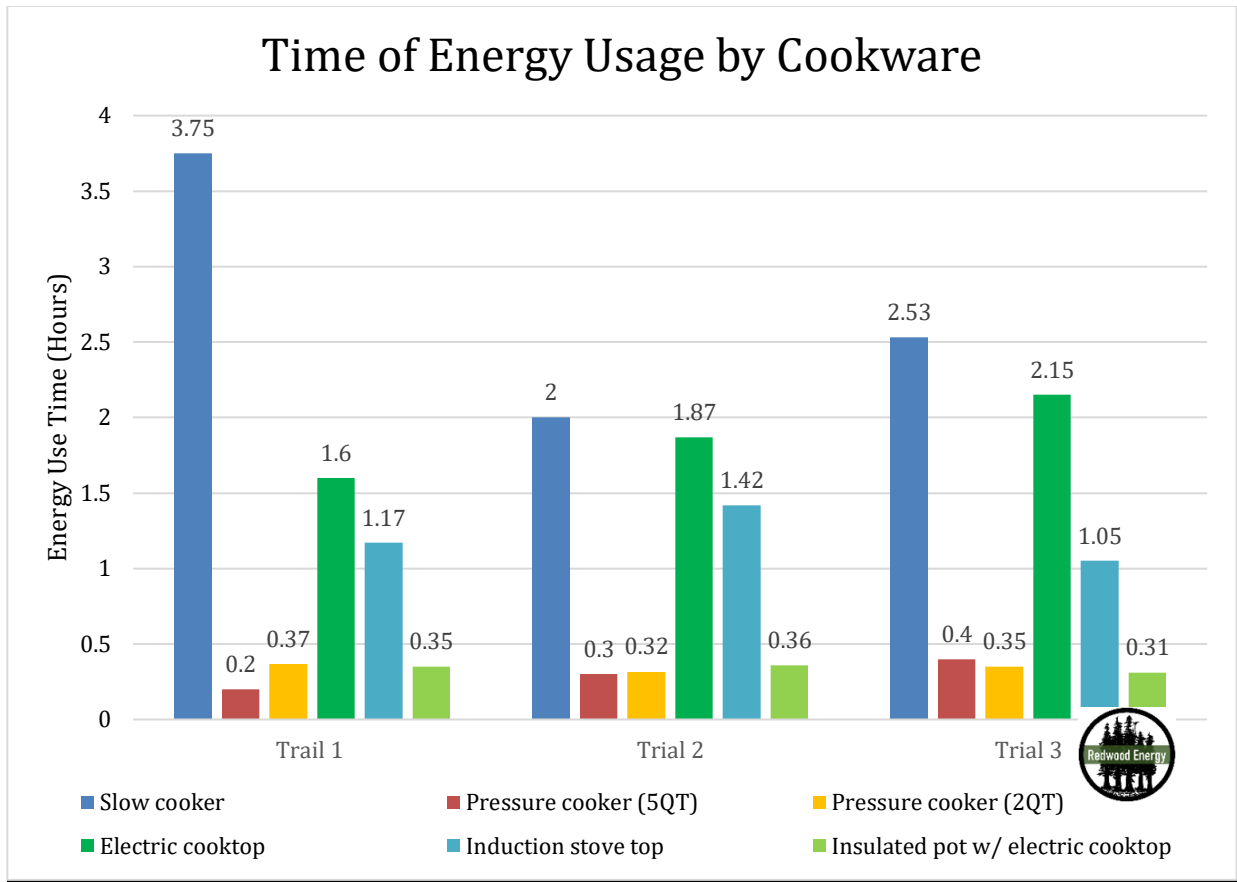


Figure 3: Cooking time by trial for each cookware.

Table 1: The summary of test results for each trial run.

Method	Trial	Energy Use (kWh)	Watt Hours/cup	Cooking Time (hours)	Material volume (cups)	Vessel volume (cups)
Slow cooker	1	0.25	50	3.75	5	8
	2	0.15	30	2		
	3	0.17	34	2.53		
Pressure cooker (5QT)	1	0.16	32	0.2	5	20
	2	0.17	34	0.3		
	3	0.18	36	0.4		
Pressure cooker (2QT)	1	0.2	40	0.37	5	8
	2	0.18	36	0.32		
	3	0.18	36	0.35		
Electric cooktop	1	0.69	138	1.6	5	10.57
	2	0.89	178	1.87		
	3	0.88	176	2.15		
Induction stove top	1	0.62	124	1.17	5	10.57
	2	0.74	148	1.42		
	3	0.56	112	1.05		
Double walled pot w/ electric cooktop	1	0.31	62	0.35	5	32
	2	0.33	66	0.36		
	3	0.29	58	0.31		

Conclusion

Time is always a factor when it comes to the convenience of cooking. The pressure cooker is a great way to limit cooking time while getting similar low energy use as a slow cooker. For a traditional cooking experience, the induction stove top is a great alternative to the electric cooktop. This method saves about 40 minutes in cooking time and uses about 22 % less energy. Induction stove tops would be the ideal installation to keep cost down without having to incite a behavior change on the user. The most energy efficient cookware requires a behavior change by the general public. Learning to use a whole new style of cooking can be a harder sell, especially with the crock pot which generally increases cooking time and is restrictive to the diversity of cooking techniques. Pressure cookers also require the user to adapt to a new way of cooking but conforms to various cooking methods. Today there are pressure cookers on the market that can perform almost any cooking method, from tasks such as roasting and browning meat to making yogurt.

The insulated pot with an electric cooktop is a good alternative to the induction stove in the sense that it decreases the need to change out the current appliances. The insulated pot is much more intuitive and familiar than a pressure cooker so using a modified pot also decreases the need for a behavior change in the resident, but this can also be a negative as the user can choose to have no behavior change at all. With induction all cookware used will reap the benefit of efficiency, where with the insulated pot on an electric cooktop the user can elect to, or not to, use the insulated pot and so generating a decrease in plug loads will be much less predictable.