BRENNAN CENTER
FOR JUSTICE
TWENTY YEARS
at New York University School of Law

Estimate for the Cost of Replacing Paperless, Computerized Voting Machines

The Brennan Center estimates that the cost of replacing the remaining paperless Direct Recording Electronic voting machines (DREs) in use in the United States would fall in the range of $130 million to $400 million. This estimate is specific to the cost of the machine itself, and does not include other items related to using and maintaining machines over time that may be included in a voting machine contract.[1] The analysis below explains our estimate.

Basis for Estimate of $130 to $400 million

a. High-end estimate of $400 million

Based on an analysis of data collected by Verified Voting, the Brennan Center estimates that approximately 43 million registered voters in 40,000 precincts cast ballots in jurisdictions where the primary Election Day voting machines are paperless DREs.[2]

For this estimate, the Brennan Center assumes that each precinct will replace its paperless DREs with precinct count optical scan voting machines (which read paper ballots) and a ballot marking device (which allows disabled voters to fill out such ballots). The two elements – the optical scan machine and the ballot marking device – would cost $5,000 each.[3] Under this scenario, the total cost for replacement will be approximately $400 million. The following table summarizes the high estimate.

Optical Scan - High Estimate	
Number of precincts	40,000
Cost per machine	$5,000
Total machine cost	**$200,000,000**
Ballot Marking Device (BMD) – High Estimate	
Number of precincts	40,000
Cost per BMD	$5,000
Total BMD cost	**$200,000,000**
Total Hardware Cost	**$400,000,000**

In truth, this estimate is probably on the high side because (1) most states use a single optical scan machine for multiple precincts and (2) many optical scan machines and ballot marking devices have been purchased for less than $5,000 each.

b. Low-end estimate of $130 million

If jurisdictions assign one optical scan voting machine and one ballot marking device for every 1,500 registered voters,[4] and optical scan machines can be purchased for as little as

$2,500 each and ballot marking devices for as little as $2,000 each,[5] the Brennan Center estimates that it would cost as little as $130 million to replace all paperless DREs in jurisdictions where they are the primary polling place equipment.

The $130 million estimate is probably too low for two reasons.

Optical Scan - Low Estimate	
Registered voters	43,000,000
Reg. per machine	1,500
Cost per machine	$2,500
Number of machines	28,667
Total Machine Cost	**$71,667,500**
Ballot Marking Device (BMD) – Low Estimate	
Registered voters	43,000,000
Reg. per BMD	1,500
Cost per BMD	$2,000
Number of BMDs	28,667
Total BMD Cost	**$57,334,000**
Total Hardware Cost	**$129,001,500**

First, not all jurisdictions will be able to allocate a single machine for every 1,500 voters. In rural or other sparsely populated areas, a single polling place may serve far less than 1,500 voters, since fewer voters live within traveling distance to a single polling place (in urban and suburban areas, a single polling place will contain multiple precincts).[6] Moreover, some states may have a legislative cap on how many registered voters can be assigned to a single voting machine.[7] In both cases, the total number of machines that need to be purchased will be greater than assumed in this estimate.

Second, while we have come across estimates that optical scan machines could cost as little as $2,500 and ballot marking devices as little as $2,000, many jurisdictions are likely to pay more than this.[8] In the past, jurisdictions that purchased machines in large quantities (major cities or states) tended to get the best price per unit. By contrast, smaller counties or less populated states – with less purchasing power - have often had to pay far more per machine.[9] In addition, some states, counties and cities have unique statutory or other requirements (for security, ballot layout, or machine reporting, for instance) that require special features which make systems more expensive.

[1] Many voting machine contracts will include charges for things like maintenance, programming, software licensing, and replacement parts. These are costs that jurisdictions will incur regardless of whether they replace their systems or not, though what they are currently paying, and what they will need to pay with a new system, will vary dramatically by jurisdiction. In addition, changing systems is likely to bring some new costs, including the cost of training election workers, educating voters, and printing ballots. These costs will vary widely based on local factors.

[2] All jurisdictions in five states Delaware, Georgia, Louisiana, New Jersey and South Carolina) use paperless DREs as the primary Election Day equipment. In addition, 460 selected jurisdictions across nine other states use paperless DREs as the primary equipment (including jurisdictions in Arkansas, Indiana, Kansas, Kentucky, Mississippi, Pennsylvania, Tennessee, Texas and Virginia).

[3] "Precinct optical scanners […] Estimated costs range from $2,500-$5,000." See *Voting Equipment.* National Conference on State Legislatures. (Jul. 7 2015), *available at* http://www.ncsl.org/research/elections-and-campaigns/voting-equipment.aspx *See also* "[…] the cost of 3,700 ballot marking machines to assist disabled voters to vote on paper ballots in each of the State's approximately 3,330 polling places (with minimal spare machines), estimated to cost $18.5 million" *Note:* The average cost per is $5,000 per device. Fiscal Note, Senate, No. 538. State of New Jersey, 216th Legislature. New Jersey Office of Legislative Services – Legislative Budget and Finance Office. May 26, 2015. *available at,* http://www.njleg.state.nj.us/2014/Bills/S1000/538_F1.PDF

[4] "Excluding, Oregon, states generally range from slightly under 1,000 to slightly over 2,000 reported registered voters per polling place." *Note:* We use the average (1,500 register voters per polling place) in our analysis. *See* U.S. Election Assistance Comm'n, 2004 Election Administration and Survey Report (Sep. 27, 2005), *available at* https://www.eac.gov/assets/1/AssetManager/2004%20EAVS%20Chapter%2013.pdf at 13-6

[5] "Precinct optical scanners […] Estimated costs range from $2,500-$5,000." See *Voting Equipment.* National Conference on State Legislatures. (Jul. 7 2015), *available at* http://www.ncsl.org/research/elections-and-campaigns/voting-equipment.aspx *See also* "Additionally, there will need to be equipment to assist voters who are blind, visually impaired or have a disability which makes it difficult for them to hand-mark a ballot and this equipment is required at each precinct. […]AutoMark is a ballot-marking device to assist visually impaired voters with marking their ballots. It is estimated that 1,449 would need to be purchased (some of these 36 counties have AutoMarks already). The cost per AutoMark device is $1,995." N.C. Gen. Ass., House Bill 607 (First Edition), Legislative Fiscal Note, available at http://www.ncleg.net/Sessions/2013/FiscalNotes/House/PDF/HFN0607v1.pdf

[6] "The distribution of the ratio of polling places to precincts is related to the size of the jurisdiction. There is a near linear decrease in the reported ratio of precincts to polling places from urban to rural jurisdictions, from1.62 for urban to 1.30 for rural jurisdictions. The average registration per polling place is also strongly related to the size of the jurisdiction. Rural areas reported almost half of the average registration per polling place than urban and suburban jurisdictions, 809 versus 1,587." *See* U.S. Election Assistance Comm'n, 2004 Election Administration and Survey Report (Sep. 27, 2005), *available at* https://www.eac.gov/assets/1/AssetManager/2004%20EAVS%20Chapter%2013.pdf at 13-7

[7] *See, e.g.*, ME. REV. STAT. 21-A, § 811(4) (1985) (requiring one voting machine for every 450 qualified voters for districts using machines); S.C. CODE ANN. § 7-13-1680 (2000) (requiring one machine for every 250 registered voters)

[8] "Precinct optical scanners […] Estimated costs range from $2,500-$5,000." *See Voting Equipment.* National Conference on State Legislatures. (Jul. 7 2015), *available at* http://www.ncsl.org/research/elections-and-campaigns/voting-equipment.aspx *See also* "Additionally, there will need to be equipment to assist voters who are blind, visually impaired or have a disability which makes it difficult for them to hand-mark a ballot and this equipment is required at each precinct. […]AutoMark is a ballot-marking device to assist visually impaired voters with marking their ballots. It is estimated that 1,449 would need to be purchased (some of these 36 counties have AutoMarks already). The cost per AutoMark device is $1,995." N.C. Gen. Ass., House Bill 607 (First Edition), Legislative Fiscal Note, available at http://www.ncleg.net/Sessions/2013/FiscalNotes/House/PDF/HFN0607v1.pdf

[9] Lawrence Norden, Brennan Ctr. for Justice, The Machinery of Democracy: Voting System Security, Accessibility, Usability, and Cost 155 (2006), available at https://www.brennancenter.org/sites/default/files/publications/Machinery_Democracy.pdf 134-135.