Analysis of benefits claimed for SMART

Executive Summary

This report summarizes SMART's impacts on traffic congestion and green house gas (GHG) emissions using information that's in SMART's Environmental Impact Reports, but hard to find. It comments on other benefits that supporters claim, such as choice and job creation. It computes cost-effectiveness measures such as cost-per-ride, and cost-per-ton of greenhouse gas reduction. It identifies questionable aspects of SMART's ridership estimates.

Background: In return for approving a ¼ cent sales tax SMART promised to build a 70-mile, 14-station rail line from Cloverdale to Larkspur. It was supposed to reduce congestion and greenhouse gas emissions, and offer options. Because costs were underestimated by 28% and tax revenue has declined by 16% SMART management has decided to substitute a 37-mile 7-station system. Latest cost estimate: $404 million.

Key findings: Even the full 70-mile system would not attract enough riders to relieve congestion on Highway 101. It would reduce peak period travel in the counties by about one half of one percent, but the EIR clearly states that's not enough to improve the Level of Service on any of the 9 segments along 101. The EIR also shows that underway and planned highway improvements on 101 will largely eliminate the worse congestion so that all segments will be operating at an acceptable level of service by 2025 with or without SMART. The EIR says SMART would increase congestion on roads near stations.

By saving some car trips SMART would decrease greenhouse gas emissions by what the EIR calls a "minimal" amount. Specifically, a 37-mile SMART train would reduce the total amount of GHG produced in Sonoma and Marin counties by about 0.05% or one part in two thousand. If one divides the cost of SMART by the amount of GHG is saves, those savings come at a cost of $10,600/ton of CO2. Many other GHG mitigation strategies cost well less than $50/ton so if GHG reduction is a key goal there are far cheaper ways to achieve it.

If SMART officials really felt offering "choice" was a good thing they would have offered voters the choice of accepting or rejecting their substitution of a 37-mile system for the 70-mile system voters approved. That aside, a SMART train would offer a "choice" for those who travel where it goes. The EIR estimates that about 1400 people or two in a thousand will find SMART convenient and use it regularly. However SMART's "choice" comes at a high price. Each one-way ride will cost roughly $55 assuming SMART's latest – but questionable- ridership forecast is correct. It would cost upwards of $164 if their original forecast is correct. In either case the rider will pay about $5 and the residents of Sonoma and Marin will pay the remainder. In addition, they will continue to subsidize the parallel bus routes on 101.

SMART is in effect transferring wealth from the many to the few. Its $400 million cost is spread across all 716,000 residents of Sonoma-Marin counties but its benefits focus

narrowly on 1400 regular users. If the subsidy was $50 per ride, taxpayers would be subsidizing each regular user at the rate of $29,000 per year.

Conclusions:
What SMART now plans to deliver is not what voters approved in 2008. The ballot said it was supposed to reduce congestion and greenhouse gas emissions. It does neither to any noticeable degree. Voters were told it would run 70 miles from Cloverdale to Larkspur and have 14 stations. It won't.

The issue isn't whether or not SMART yields some minor benefits, but rather whether those benefits are worth $400 million, and whether spending $400 million on other things would yield a larger benefit to society.

In other words, SMART can't deliver the system promised, and the system promised couldn't deliver the benefits promised. SMART costs too much and does too little.

Background

In return for voter approval of a ¼ cent sales tax SMART promised to build a 70-mile, 14 station rail line from Cloverdale to Larkspur, plus an adjacent bike path. Service was to start in 2014 and attract 5050 one-way riders. The total cost was projected to be $541 million. At the tail of the boom in 2008 voters approved this deal. Subsequently the SMART Board reduced the route to 37 miles with 7 stations, delayed service until 2016, and now says this half-system will cost $404 million and attract only 2860 one-way rides daily. Assuming each rider makes a round trip SMART would serve about 1430 people. (SMARTs last cost estimate for the full 70-mile system was $695 million, a 28% increase.) SMART hasn't given their customers (the taxpayers) the choice to accept or reject this less attractive package, so a grass roots initiative called "Repeal SMART" has formed to restore that right.

The 2008 ballot began with these words:

"To relieve traffic, fight global warming and increase transportation options, shall Sonoma-Marin Area Transit District be authorized to provide two way passenger trains service…by levying a ¼-cent sales tax for 20 years…"

Other words three main benefits were promised when the voters were asked to approve SMART: traffic congestion relief, greenhouse gas reduction, and the offering of a transportation option or choice.

Because economic conditions have deteriorated since 2008 and because voters may have another say it's time to reassess whether SMART is able to provide those benefits.

NOTE: To be conservative most of the analysis below assumes a 37-mile 9-station version of SMART actually would attract 2860 daily one-way riders as SMART claims in its latest

ridership forecast. However an earlier forecast indicated the ridership on the 7-station version which SMART now plans to build could be as low as 1198. For a variety of reasons it's not possible to determine which is correct. See the DETAILS section for more about this serious inconsistency.

Traffic congestion

The effect of the full 70-mile SMART rail on Highway 101 traffic congestion is nicely summarized in the following table from SMART's DEIS. It reports level-of-service or LOS, which is a measure of traffic congestion. A is the best grade, F the worst. D or better is considered acceptable.

TABLE 3.6-8A
YEAR 2025 HIGHWAY 101 LEVEL OF SERVICE SUMMARY
PM PEAK HOUR
MIXED FLOW LANES

#	Segment	Direction	2000 P.M. Peak Hour					2025 P.M. Peak Hour							
			Number of lanes	Capacity	Existing			Number of lanes	Capacity	No Project			Rail Project		
					Volume	V/C	LOS			Volume	V/C	LOS	Volume	V/C	LOS
1	Citrus Fair Drive (Cloverdale) to Windsor River Road (Windsor)	NB	2	4,000	4,200	1.05	**F**	2	4,000	3,600	0.90	D	3,600	0.90	D
2	Windsor River Road (Windsor) to Third Street (Downtown Santa Rosa) *	NB	2	4,000	4,500	1.13	**F**	3	5,200	3,500	0.67	B	3,400	0.65	B
3	Third Street (Downtown Santa Rosa) to Rohnert Park Expressway (Rohnert Park)	NB	2	4,000	3,900	0.98	E	2	4,000	3,200	0.80	C	3,100	0.78	C
4	Rohnert Park Expressway (Rohnert Park) to Corona Road (Petaluma) *	NB	2	4,000	3,700	0.93	E	3	5,200	3,900	0.75	C	3,900	0.75	C
5	Corona Road (Petaluma) to State Route 116 (South Petaluma)	NB	2	4,000	3,800	0.95	E	2	4,000	2,900	0.73	C	2,900	0.73	C
6	State Route 116 (South Petaluma) to Atherton Avenue (Novato Narrows)	NB	2	4,000	4,400	1.10	**F**	3	6,000	3,300	0.55	A	3300	0.55	A
7	Atherton Avenue (Novato Narrows) to State Route 37 Interchange (Novato)	NB	3	6,000	5,400	0.90	D	3	6,000	5,000	0.83	D	5,000	0.83	D
8	State Route 37 Interchange (Novato) to North San Pedro Road (San Rafael)	NB	4	8,000	7,500	0.94	**E**	5	10,000	7,500	0.75	C	7,300	0.73	C
9	North San Pedro Road (San Rafael) to Sir Francis Drake Boulevard (Larkspur)	NB	4	8,000	7,900	0.99	**E**	4	8,000	4,900	0.61	B	4,900	0.61	B
1	Citrus Fair Drive (Cloverdale) to Windsor River Road (Windsor)	SB	2	4,000	2,000	0.50	A	2	4,000	2,200	0.55	A	2,200	0.55	A
2	Windsor River Road (Windsor) to Third Street (Downtown Santa Rosa)	SB	2	4,000	2,800	0.70	B	3	5,200	3,600	0.69	B	3,800	0.73	C
3	Third Street (Downtown Santa Rosa) to Rohnert Park Expressway (Rohnert Park)	SB	2	4,000	3,900	0.98	E	2	4,000	3,600	0.90	D	3,500	0.88	D
4	Rohnert Park Expressway (Rohnert Park) to Corona Road (Petaluma)	SB	2	4,000	3,600	0.90	D	3	5,200	4,400	0.85	D	4,300	0.83	D
5	Corona Road (Petaluma) to State Route 116 (South Petaluma)	SB	2	4,000	3,500	0.88	D	2	4,000	3,600	0.90	D	3,600	0.90	D
6	State Route 116 (South Petaluma) to Atherton Avenue (Novato Narrows)	SB	2	4,000	3,500	0.88	D	3	6,000	3,600	0.60	A	3,600	0.60	A
7	Atherton Avenue (Novato Narrows) to State Route 37 Interchange (Novato)	SB	3	6,000	4,600	0.77	C	3	6,000	5,100	0.85	D	5,000	0.83	D
8	State State Route 37 Interchange (Novato) to North San Pedro Road (San Rafael)	SB	4	8,000	5,300	0.66	B	5	10,000	6,600	0.66	B	6,700	0.67	B
9	North San Pedro Road (San Rafael) to Sir Francis Drake Boulevard (Larkspur)	SB	4	8,000	4,100	0.51	A	4	8,000	5,600	0.70	B	5,700	0.71	C

* Third lane is an auxiliary lane between ramps; capacity adjusted to include auxiliary lane facilty
Source: Parsons Brinckerhoff, MTC 2001 RTP, based on forecasted horizon year 2025 (August 2005).

The table shows decisively that the full 70-mile version of SMART rail will not improve the level of service (ie: congestion) on any of the 9 segments along Highway 101. For instance row 1 shows that LOS on segment 1 in 2025 will be "D" without the rail project and still "D" with rail. The top row also shows that LOS is expected to improve from "F" in year 2000 to "D" in 2025 with or without rail, as highway improvements already planned or underway

are completed. Likewise Segment 6, the Novato Narrows, is expected to improve from todays level "F" to level "A" with or without rail. SMART deleted this table from the Final EIR, perhaps because they wished to suppress these findings.

The DEIS did however make this comment about congestion on page 3-99:

> particularly during the p.m. peak period. However, increased traffic demand impacts on local roadways providing access to station sites may be significant and unavoidable, if identified mitigation is determined to be infeasible.

The DEIR does not say if the mitigations are feasible or how much they might cost.

Greenhouse Gas and Energy

SMART's analysis of energy and thus GHG impacts is confusing and questionable. The concluding statements from page 4-59 its Revised DEIR (FEIR) for the 70-mile system are:

> When compared to the existing condition, the difference between the proposed project and the No-Project Alternative is minimal. Both scenarios result in an increase in energy use due to projected

and:

> The proposed project would result in a ~~0.2~~ 0.4 percent decrease in total direct energy consumption compared to the No-Project Alternative. Relative to future conditions without the proposed project,

In this case Direct energy means annual recurring energy used by private vehicles plus bus and rail transit vehicles in the "project corridor". Truck energy is not included. The "project corridor" is a strip of land adjacent 101. It includes cities it bisects but not the entirety of Marin or Sonoma counties. The energy savings come entirely from SMARTs estimate that passenger vehicle miles of travel or VMT within the "project corridor" will decline by 26 million annually in 2025, as people switch from driving to riding SMART. SMART concluded the full 70-mile system would reduce Direct energy by 0.4%. The truncated system would save roughly half that or 0.2%.

Because the EOR data relate to a "project corridor" not entire counties, contains questionable conversions of VMT to energy, has a confusing definition of maintenance energy, and has other issues SMARTs DEIS energy findings are not very understandable or credible.

The following is a more straightforward way to assess SMARTs help in reducing GHG emissions: Transportation and all other energy uses in Sonoma and Marin currently produce 6.7 million tons of GHG annually. Assuming the reduction in VMT claimed by SMART occurs and that passenger vehicles average 35 MPG in 2025, the 37-mile SMART train would reduce the total amount of GHG produced in Sonoma and Marin counties by about 0.05% or one part in two thousand. This assumes it attracts 2860 riders.

That's helpful but is it worth $404 million? Could we achieve a greater GHG reduction by spending the money on more efficient mitigation strategies?

Cost effectiveness of SMART as a way to reduce GHG: Reducing GHG is perhaps humanities most critical challenge. The problem is enormous and resources are limited. SMARTs total cost over 20-years is $799 million minus $99 million in fare revenue, giving an average annual cost of about $35 million. (From 2/16/2011 Financial Plan) If a primary reason for building SMART is to reduce GHG then its reasonable to divide its annual cost of about $35 million by the amount of GHG it saves annually (3300 tons) to get a rough measure of its cost-effectiveness. Doing so shows SMART will reduce GHG at a cost of $10,600 per ton. (Again this is based on a 37-mile system attracting 2860 riders.)

This vastly exceeds the cost of other GHG reduction strategies. One large study listed many strategies the average cost of which was about $5 per ton. Another study ranked a list of ways to reduce GHG by their relative cost. Many actually saved money. The most expensive on the list cost about $100 per ton. At $10,600 per ton SMART is a vastly inefficient way to reduce GHG. See the "DETAILS" section below for sources and quotes from these studies.

By way of example its interesting to compare the cost of SMART with the cost of installing compact fluorescent bulbs as ways to reduce GHG. Calculations show that replacing 100,000 sixty-watt incandescent bulbs with compact fluorescent (CF) bulbs would yield the same GHG savings as the 37-mile version of SMART. (See "DETAILS" section for the calculations). If GHG reduction is societies goal then spending about $300 thousand to replace incandescent with CF light bulbs would achieve the same benefit as spending $400 million on SMART. Put another way, we could save over 1000 times more GHG savings by spending $400 million replacing light bulbs than by building SMART. Put another way, if each of the 716,000 residents in Sonoma and Marin replaced just one incandescent with one compact fluorescent it would reduce GHG emissions seven times more than building SMART.

Offers "alternative", "option", or "transportation choice":

If SMART officials really believed giving people "choice is a good thing then why haven't they given voters the choice of accepting or rejecting their plan to substitute a 37-mile system for the original 70-mile system they promised?

This aside, SMART would indeed offer a transportation choice. This benefit would be a gift from the many to the relative few who commute regularly between Santa Rosa, San Rafael and cities in between. Taxpayers already subsidize Golden Gate Transport (GGT) express bus service in the 101 corridor. Those buses will continue to operate with or without SMART for those destined to downtown San Francisco, or perhaps even the Larkspur ferry, which SMART won't reach in the foreseeable future. With SMART there would be two taxpayer subsidized transit modes running along side by side in the same corridor. Even so, SMART proposes that the 716,000 residents of Marin and Sonoma counties spend $400 million in order to give 1430 people the option of taking a train rather than a bus. In other words about 500 people will pay in order to give one person a useful choice.

The cost of providing this "choice" to these 1430 people is rather large. Assuming SMART attracts 2860 weekday riders the cost per one-way ride is $55. After deduction a $5 fare the taxpayer subsidy is $50 per one-way ride. If each user makes one round trip a day and 290 round trips per year the annual subsidy for each user comes to $29,000. (See Cost per Ride section below for more about how these numbers were calculated)

Why is offering choice good? Society can offer choice for one of two reasons. First is the altruistic reason of giving people choice as a form of gift. In this case 716,000 people would be spending $400 million to provide that choice for the 1400 who happen to commute along the 101 corridor and would find the train more attractive than the bus. It's a nice thing to do, but why give a gift to this particular group rather than giving a gift more widely available across both counties? For instance, why not have a county-wide lottery the winners of which would each be given a re-sellable gift certificate for $10,000 off on the purchase of a hybrid car? They would have the choice of using it or not. This transportation choice is a gift, but it's a gift everyone has an equal chance to receive.

A second reason for offering choice is essentially selfish. Society offers people a choice because it expects them to change behavior in a way that returns social benefit to all. In this case society decides to spend $400million on a train expecting that people will reduce driving and thus reduce congestion and GHG, which benefits everyone or at least a larger group. But that equation doesn't work in this case because SMART won't reduce congestion or save enough GHG to return meaningful benefits to society. In other words, money is wasted because the expected benefit won't materialize.

OTHER ALLEGED BENEFITS

SMART supporters have alleged a number of benefits without –with one exception- proving they are valid. Some alleged benefits quoted in the Press Democrat are: "transportation choice", "compliment existing options", " would mean more congestion..", "economic stimulus", "create and promote local economy", "safety valve for freeway-dependent commuters", "make the region more attractive to businesses seeking to expand or relocate". The chairman of Friends of SMART claims: "SMART is good for the future. It will relieve dependence on petroleum, it will create jobs, it will promote tourism." (PD, Nov. 18,2011. Finally, SMART's general manager recently said: "…compliment existing transit options in a way that combats congestion and pollution; ….bringing ongoing economic benefits…." PD 10/2/11 Page B7.

If these were valid impacts of SMART they should have been mentioned in the EIR and given scientific support. Instead, the Executive Summary of the EIR mentions none of them, except for saying SMART will offer an alternative or option.

Some comments follow.

Job creation: SMART will both create and destroy jobs. Clearly SMART will create some jobs, including very well paying lifetime jobs for its staff and short-term construction jobs. On the other hand it will destroy jobs over the next 20 years because the money going to SMART is money taxpayers can't spend in other ways that would also create jobs. For instance, businesses consistently say the reason they aren't hiring is that people aren't spending. SMART's regressive sales tax (which hurts lower income folk the most) makes this problem worse. Since SMART has not published a scientific estimate of its net impact on jobs there is no legitimate basis to claim that building SMART would increase net employment. (see DETAILS section for a link to SMART staff jobs)

"Good for the future": This vague assertion by a SMART fan ignores the fact that SMART's bonds put us and our children further in debt. Recent history shows the consequences when individuals and governments accumulate too much debt. Nor will the current ¼ cent sales tax be enough. An extension will be needed to subsidize operations beyond 2029. In addition, if SMART is to complete the 70-mile system promised, still more taxes would be needed. Beyond the accumulation of debt issue there may be an upper limit on how high sales taxes can be raised. If we max out the government's credit card funding SMART we may be unable to raise taxes later for more important needs like schools, roads, or disaster recovery.

"Promote tourism": It's not clear why SMART would help since most tourists probably want to visit wineries, parks, or beaches. It would be far easier for them to drive straight to their destination than drive to a SMART station, wait for a train, then rent a car to reach their destination. In addition SMART trains would not run often during middays and weekends.

The core issue: The question is not whether SMART provides benefits, but rather whether those very modest benefits are worth $404 million. Is building SMART the best way to spend $404 million?

Other comments and comparisons

Cost per Ride: SMART's financials are extraordinarily complex. However, an easy way to calculate the approximate cost per one-way ride on the 37-mile 9-station version of SMART is as follows. SMART's Financial Plan dated 2/16/11 shows SMART will collect $799 million between when the ¼ cent sales tax was first imposed and when it expires in 2029. This is essentially the total cost of SMART over that 20-year period. SMART's Update Ridership Forecast claims the 9-station version of the IOS will have 2860 weekday riders growing to 4818 by 2035. From this one can calculate that year 2029 ridership would be 4232 and that average ridership between start of operations – the financial plan assumes 2015- and 2029 will be 3546. When multiplied by 290 (to convert weekday to annual) the average yearly

ridership comes to 1.03 million and the 14-year total is 14.4 million one-way rides. Dividing the total cost over those years by the total rides shows each ride would cost $55.

If SMART riders paid $5 –about the fare on GGT buses—then the taxpayer subsidy would come to about $50 per ride.

As explained in the DETAILS section below SMART's ridership estimates are questionable and it's plausible that the currently planned 7-station version of SMART would only attract 1198 weekday riders by 2025. Using this for the average between 2015 and 2029 means SMART may only provide 4.86 million rides over the 14 years. (1198 x 290 x14) At this level of ridership each one-way ride would cost $164. If riders paid $5 then taxpayers would be paying about $160 to subsidize each ride.

Cost per citizen: The 37-mile 7-station version of SMART will continue to cost every man, woman in child in Sonoma and Marin counties an average of $49 per year, every year, for the next 17 years. (SMARTs total cost over 20-years of $799 million minus $99 million in fare revenue gives and average annual cost of annual cost of $35 million divided by 716,000 residents.) This is based on Ridership Update Forecast of 2860 riders in 2015 growing to 4818 by 2035. If reality were lower then cost per resident would rise.

Concentration of benefits: Everyone pays, few benefit. About 1500 or 0.2% of Sonoma/Marin's 716,000 residents have the benefit of riding.

Spending on roads vs SMART: Not yet written.******compare ¼ sales tax in Sonoma with annual road maintenance in Sonoma county.******

Spending on parks vs SMART: The ¼ sales tax in Sonoma county collects enough in one year (about $12M) to keep Annadel open for about 35 years.

---------- Details ----------

How Accurate are SMART's Ridership and Cost estimates?

Industry experience: Hopefully SMART's data is objective and accurate. However, at least two studies found that isn't always the case with such projects. Clearly the agency hoping to build a project and the consultants they hire to estimate cost and ridership have a serious conflict of interest between the need to publish honest -but perhaps unfavorable- data that may kill the project, and the benefits they receive if the project goes ahead.

Abstracts from one study follow:

Bent Flyvbjerg
Professor, Research Director, Dr. Techn., Dr. Scient., and Ph.D.

Notice: On April 1, 2009, Bent Flyvbjerg moved to University of Oxford. Flyvbjerg's Aalborg website is up to date until the time of his move. After this date, please see his site at Oxford:
www.sbs.oxford.edu/bentflyvbjerg

"How (In)accurate Are Demand Forecasts in Public Works Projects? The Case of Transportation." Principal author: Bent Flyvbjerg; co-authors: Mette Skamris Holm and Søren L. Buhl. *Journal of the American Planning Association*, vol. 71, no. 2, Spring 2005, pp. 131-146.
Abstract: This article presents results from the first statistically significant study of traffic forecasts in transportation infrastructure projects. The sample used is the largest of its kind, covering 210 projects in 14 nations worth US$59 billion. The study shows with very high statistical significance that forecasters generally do a poor job of estimating the demand for transportation infrastructure projects. For 9 out of 10 rail projects, passenger forecasts are overestimated; the average overestimation is 106%. For half of all road projects, the difference between actual and forecasted traffic is more than ±20%. The result is substantial financial risks, which are typically ignored or downplayed by planners and decision makers to the detriment of social and economic welfare. The data also show that forecasts have not become more accurate over the 30-year period studied, despite claims to the contrary by forecasters. The causes of inaccuracy in forecasts are different for rail and road projects, with deliberately slanted forecasts playing a larger role for rail than for road. The cure is transparency, accountability, and new forecasting methods. The challenge is to change the governance structures for forecasting and project development. The article shows how planners may help achieve this.

"Underestimating Costs in Public Works Projects: Error or Lie?" Principal author: Bent Flyvbjerg; co-authors: Mette K. Skamris Holm and Søren L. Buhl. *Journal of the American Planning Association* , vol. 68, no. 3, Summer 2002, pp. 279-295.
Abstract: This article presents results from the first statistically significant study of cost escalation in transportation infrastructure projects. Based on a sample of 258 transportation infrastructure projects worth US$90 billion and representing different project types, geographical regions, and historical periods, it is found with overwhelming statistical significance that the cost estimates used to decide whether such projects should be built are highly and systematically misleading. Four types of explanation are tested: Technical, psychological, economic, and political. Underestimation cannot be explained by error and is best explained by strategic misrepresentation, that is, lying. The policy implications are clear: legislators, administrators, investors, media representatives, and members of the public who value honest numbers should not trust cost estimates and cost-benefit analyses produced by project promoters and their analysts.

Specific issues concerning SMART's ridership forecasts: SMART's various ridership forecasts are inconsistent, questionable, and not up to date. What follows is an admittedly tedious analysis.

The main point to take away is that SMARTs claim that a 9-station version of the IOS will attract 2860 weekday one-way rides when it begins operating in 2015 or thereabouts may be overstated.

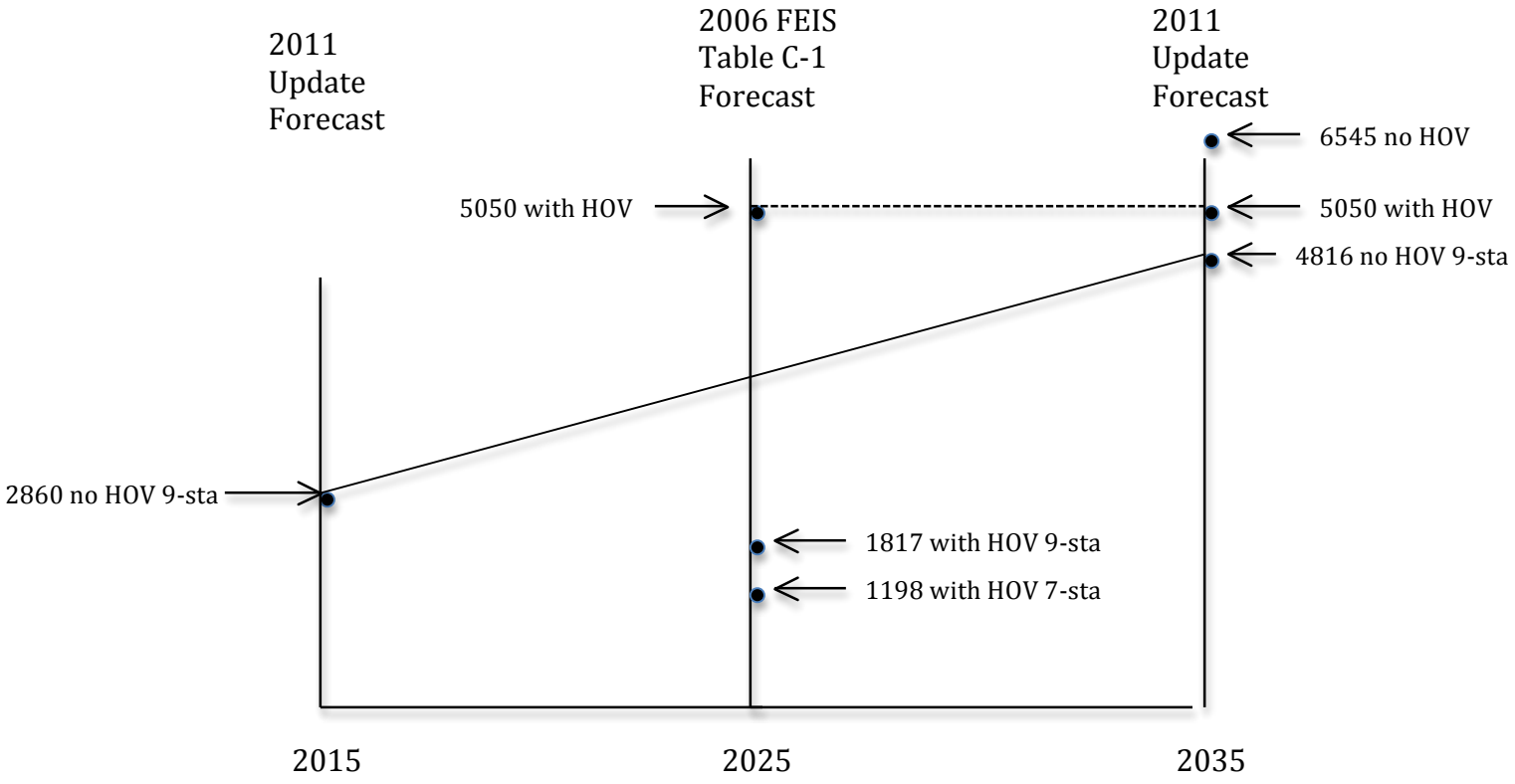
Some issues are as follows.

To review what SMART said: The original EIR competed in 2006 forecast that a 70-mile, 14-station SMART system would have 5046 weekday riders by 2025 assuming the HOV lanes (ie: Narrows widening) were completed. (See Table C-1 below from the June 2006 FEIR) Table C-1 also showed that ridership between the 9 stations comprising the first version of an IOS would be 1817, and it would be 1198 between the 7 stations in the latest version of an IOS. On Feb.16, 2011 a Ridership Update Forecast was presented to the SMART Board. (available on SMART's web site) It said the full system would attract 5050 riders by 2035 assuming the HOV lanes were completed, or 6545 if they weren't. It also said a 37-mile, 9-station version of the initial operating segment or IOS would attract 2860 riders shortly after opening in 2015 and that ridership would grow to 4818 by 2035. This forecast was based on the assumption that the HOV lanes were not competed. It did not say what IOS ridership would be if the HOV lanes were complete. What appears wrong about these forecasts?

TOTAL DAILY Station	Cloverdale	Healdsburg	Windsor	Santa Rosa–Jennings Ave	Downtown Santa Rosa	Rohnert Park	Cotati	Peta luma–Corona Road	Downtown Petaluma	North Novato	South Novato	Marin Co. Civic Center	San Rafael	Larkspur	Total
Cloverdale	0	6	3	7	36	9	2	0	30	1	0	1	2	1	98
Healdsburg	6	0	178	45	78	41	16	2	35	2	1	3	4	2	413
Windsor	3	177	0	78	197	76	28	2	50	3	1	7	9	6	637
Santa Rosa–Jennings Av.	7	46	82	0	187	109	60	15	53	10	3	10	13	9	605
Downtown Santa Rosa	36	82	206	195	0	76	102	65	29	17	5	14	13	6	847
Rohnert Park	9	43	79	109	77	0	48	38	18	11	3	13	12	8	469
Cotati	2	17	29	59	97	49	0	14	80	15	4	14	12	10	401
Petaluma–Corona Road	0	2	2	15	65	38	14	0	14	11	2	13	15	12	204
Downtown Petaluma	30	35	50	52	27	18	80	14	0	23	5	20	12	9	377
North Novato	1	2	4	11	18	11	17	11	32	0	4	35	27	17	189
South Novato	0	1	1	3	5	3	4	2	5	4	0	23	25	17	94
Marin Co. Civic Center	1	3	7	10	14	13	14	13	20	34	22	0	66	76	295
San Rafael	2	4	9	13	13	12	12	15	13	27	26	80	0	9	235
Larkspur	1	2	6	9	6	8	10	12	9	17	17	74	9	0	182
Total	98	420	657	606	820	465	409	204	388	175	93	308	220	183	5,046

NOTE: To find ridership on the 9-station version of the IOS delete the first four columns and first four rows, and the Larkspur column and row. Next compute the row totals. Lastly, sum the row totals. Doing so shows the 9-station IOS would attract 1817 daily one-way rides. To get ridership on the 7-station IOS delete also the Corona Road and North Novato stations. This yields 1198 riders. These are approximations since some people who would have used a now deleted station would drive to the next closest one. Their numbers would be limited because the problem is not so much driving further to reach a station for boarding but rather finding a way to reach the final destination after disembarking.

The diagram below –which is not to scale- shows the various forecasts of daily ridership. They apply to the 70-mile, 14 station system except as noted.



Issue #1: Conflicting answers: SMARTs two different forecasts appear to give very different ridership estimates for a 9-station IOS. Table C-1 suggests it would be about 1817 rides whereas the Update Forecast claims 2860. This large difference is made worse because the 1817 was for year 2025 whereas the 2860 was for ten years earlier. If anything the ridership in 2025 should be higher than the ridership in 2015. This large difference and the fact it goes in the wrong direction suggests one of those forecasts is wrong. This is especially puzzling since both studies came up with the same ridership (5050) in the out years for the 70-mile system, suggesting that the FEIR and Ridership Update Forecast models must have used about the same population growth assumptions. If the two studies predicted about the same ridership on the 70-mile system why did they predict such different results for a 9 stations system? And what is the correct forecast for the 9-station IOS? (the original Table C-1 forecast, the Update Forecast, or neither?)

Issue #2: Inconsistency: The Update Forecast said that ridership on the 37-mile, 9-station IOS would comprise 74% of the ridership on the much larger 70-mile 14-station system.(4818/6545) This was apples to apples since both numbers assumed the HOV lanes

would not be complete. However Table C-1 portrayed a much different result. Table C-1 shows the 37-mile system would have just 36% as many riders as the full system. (1817/5050). This was also apples to apples but assumed the HOV lanes would be complete. Why such different ratios?

Issue#3: Missing data: Although the Updated Forecast reported IOS ridership assuming the HOV lanes would not be finished, it did not report ridership assuming they would be, which seems more likely. Why not? What would that ridership number be?

Issue#4: Questionable assumption about HOV lane completion: Why did SMART's latest ridership estimate of 4818 riders by 2035 -which was also a key input the financial plan—assume the HOV lanes would not be completed? It seems more likely they would be complete by then.

Issue#5: Growth rate: The Update Forecast ridership on the IOS was predicted to grow from 2860 in year 2015 to 4818 in year 2035. That seems excessive because once the system is up and running ridership should probably grow slowly in pace with population. That's one reason the 4818 number seems too high. Another is that completion of the HOV lanes will occur in the interval lowering the appeal of rail. Finally, it's hard to believe that the IOS, which is basically a half-system, would have 74% as much ridership as the entire system.(4818 vs. 5050)********* Is 4818 a credible number?

Issue#6: Old information: SMART should be publishing and using ridership for the 7-station IOS not a 9-station IOS because the 7-station is what they are now planning and all they can now afford. SMART should publish year 2015 ridership, year 2025 ridership assuming the HOV lanes are complete, and year 2035, all assuming a 7-station IOS and assuming completion of the HOV lanes by 2025.

Issue #7: Need to update GHG and other EIR findings: IF the Update Forecast is correct and 2860 is correct for a 9-station system, something less is correct for a 7-station system. Thus any benefits calculated in the EIR, which were based on having 9-stations attracting 2860, should be revised down. IF on the other hand Table C-1 is correct, year 2025 ridership between those 7 stations would be only 1198 trips per day, and all GHG and other impacts should be recalculated on this basis.

SMARTs Draft EIR, revised Draft EIR, Final EIR, Supplemental EIR, and changes appearing in Board meeting minutes since have left a confusing mess. None of them report the impacts of the 7-station system SMART now plans to build. At minimum, a short EIR for the 37-mile, 7-station system should be written. It need not repeat everything but it should recalculate and report ridership, GHG savings, impacts on congestion, and anything else that has changed materially between the original 70-mile system and the 37-mile, 7-station IOS.

Issue#8: Impact on financials: SMARTs financial plan is based on the assumption that ridership will be 2860 in year 2015 and grow straight-line to 4818 in 2035. However, the comments above suggest it could start as low as 1198 and afterward tend to increase with population but

decrease as congestion on 101 is eased by HOV and other highway projects. It's also based on the questionable assumption that the HOV lands will not be completed. In addition, it appears the financial plan is based on a 9-station IOS, not a 7-station IOS. In short, are SMARTs financial plans using accurate and relevant ridership forecasts?

In sum, it is not possible using SMARTs various incomplete and seemingly conflicting forecasts for an outside observer to determine what ridership would be on the 7-station IOS SMART now plans to build. Large differences between what SMART said at one time and what they said at another are hard to explain. Having the correct number is critical. It directly determines cost-effectiveness numbers like cost per ride. It also directly effects how many vehicles will be taken off the road and thus SMARTs impact on GHG emissions. And it has serious effects on SMART's financial prospects.

Energy and GHG

SMARTs energy savings are questionable and overstated. A few details from Revised DEIR (FEIR) Tables 3.8-4 and -5 helps explain why. The tables list two types of energy impacts: so called "Indirect" energy for construction and vehicle maintenance over some unspecified period ending in 2025, and "Direct" energy used for vehicle operation.

Because it's confusing and relatively minor compared to Direct energy Indirect energy it not discussed here, except as follows. The Indirect energy without the "project" totaled 16,073 billion BTUs, 99% of which was for the manufacture and maintenance of private passenger vehicles. With the project it dropped to 16,011 for a claimed savings of 62 billion BTUs or 0.4%. This finding is suspect because the savings resulted entirely from SMART's assumption that the existence of SMART would cause Sonoma and Marin residents to own fewer cars, and thus these cars wouldn't be manufactured. SMART offered no support for their questionable assumption.

Apparently using an assumption that passenger vehicles would average 18 MPG in 2025, SMART estimated that the 70-mile system would reduce "Direct" energy from 35,720 Billion BTUs/yr. to 35,564, a savings of 0.4%. The currently planned 37-mile system -having about half the ridership- would save about 0.2%. GHG is directly proportional to BTUs so this means that GHG would also be reduced by 0.2%.

This result is confusing because it relates only to energy used by passenger and transit vehicles in the project corridor while ignoring trucks and non-transportation forms of energy use. To put SMART's GHG saving in a more useful perspective its compared with total GHG produced in Sonoma and Marin Counties from all sources. The comparison begins by assuming passenger vehicle will do better than 18 MPG by 2025, and it uses direct VMT to GHG conversions from the EPA.

"EPA currently intends to propose standards that would be projected to achieve, on an average industry fleet wide basis, 163 grams/mile of CO2 in model year 2025 (this would be equivalent, on a mpg-equivalent basis, to 54.5 mpg" (Federal Register Vol. 76, No. 153, Aug. 9, 2011)

Table 3.8-5 says the 70-mile SMART train with a ridership of 5050 would save 26 million VMT in 2025. If it has about half the ridership (2860) the currently proposed 37-mile system would save about 13 million VMT. According to the EPA one VMT produces 0.000435 tons of GHG at todays average vehicle efficiency of 20.4 MPG. But if we assume vehicles will average 35 MPG by 2025 then one VMT will produce 0.00025 tons of GHG. Thus reducing VMT by 13 million should reduce GHG by 3300 tons. 3300 is 0.05% of the 6.7 million tons of GHG produced by all energy uses in Sonoma and Marin counties. In sum, SMART with 2860 riders would reduce GHG produced in Sonoma and Marin by 0.05% or one part in two thousand.

These added details reinforce the FEIR's overall conclusion that the reduction in energy use and thus greenhouse gas resulting from SMART will be minimal.

Cost effectiveness of SMART vis a vie other ways to reduce GHG

Looking at the research: If a primary reason for building SMART is to reduce greenhouse gas then it makes sense to ask if SMART is cost-effective relative to other ways to achieve this goal. To reduce GHG by the enormous amounts science –and perhaps our survival- demands it makes sense for society to focus on getting the most bang for the buck by investing limited funds on only the most cost effective strategies. There has been considerable research on the cost-effectiveness of GHG mitigation strategies, much easily found on the web. The following report concluded that many strategies can reduce GHG at an average cost of about $5 per metric ton. A paragraph and table from that report follow:

> Taking into account the benefits to consumers of the greenhouse gas standards for light duty vehicles and the energy efficiency measures now underway in California, this study finds that carbon reductions sufficient to meet the Governor's targets can be achieved at no net cost to consumers and likely at a net benefit in both 2010 and 2020. The measures identified by the Center have average costs of just $5.25 per ton and $5.77 per ton in 2010 and 2020, respectively. The low cost of CCAP's measures is due to the fact that many measures have a cost of less than zero (i.e., a net benefit) and a significant portion of the measures studied have a cost between zero and $10 per ton.

Table 5
Average Cost of Reductions Below $30 per metric ton CO_2e

Sector	2010			2020		
	MMT CO_2e	Cost (2000$)	Avg Cost	MMT CO_2e	Cost (2000$)	Avg Cost
Agricultural/ Forestry	5.8	$62,628,000	$10.80	13.7	$153,807,000	$11.23
Cement	1.79	-$11,803,237	-$6.59	1.93	-$15,131,759	-$7.83
HFC	0.88	$3,131,500	$3.56	6.22	$9,088,500	$1.46
Methane	15.38	$36,173,940	$2.35	16.55	$39,100,530	$2.36
Oil Refining	TBD	TBD	TBD	TBD	TBD	TBD
PFC	3.1	$60,558,200	$19.53	7.14	$139,625,500	$19.56
Power	TBD	TBD	TBD	TBD	TBD	TBD
SF6	1.18	$3,728,800	$3.16	1.51	$8,199,300	$5.43
Transportation	1.27	$0	$0.00	10.96	$0	$0.00
Total	**29.40**	**$154,417,203**	**$5.25**	**58.01**	**$334,689,071**	**$5.77**

From: Cost Effective GHG Mitigation Measures for California, Summary Report: An Independent Analysis of Measures to Reduce Greenhouse Gas Emissions in 2010 and 2020 to Meet Executive Order S-3-05. Jan 19, 2006. *www.fypower.org/pdf/CCAP_CA_**GHG**.pdf*

Quotes and a chart from "a widely cited 2007 report" by McKinsey & Company follow:

Reducing US greenhouse gas emissions: How much at what cost?

Consensus is growing among scientists, policy makers, and business leaders that concerted action will be needed to address rising greenhouse gas (GHG) emissions in the United States. The discussion is now turning to the practical challenges of where and how emissions reductions can best be achieved, at what costs, and over what periods of time.

The central conclusion

The United States could reduce GHG emissions in 2030 by 3.0 to 4.5 gigatons of CO2e using tested approaches and high-potential emerging technologies. These reductions would involve pursuing a wide array of abatement options with marginal costs less than $50 per ton, with the average net cost to the economy being far lower if the nation can capture sizable gains from energy efficiency.

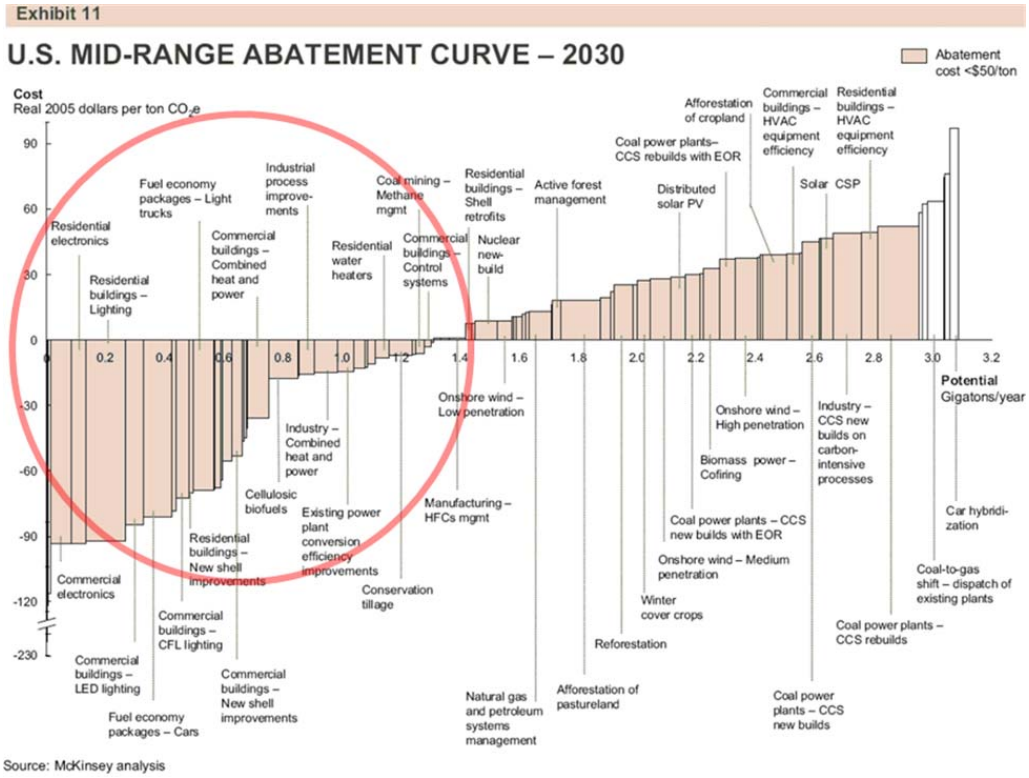


Figure 1. McKinsey & Company Cost Curve (The consultant team focused on the actions that could provide cost-effective reductions, which are shown in the circle.)

Source: McKinsey report as found on
www.mckinsey.com/en/Client_Service/Sustainability/Latest_thinking/Reducing_US_greenhouse_gas_emissions.aspx

This chart shows that many GHG reduction strategies actually save more than they cost. All those in the chart cost less than $100 per ton, most less than $50. SMART, at $10,600 per ton, does not compare favorably.

SMART vs Geysers project:

SMART vs Compact Flourscent Lights: As noted above the 37 mile version of SMART would save about 3300 tons of GHG per year assuming it has 2860 riders. Substituting a 14 watt compact flourscent (CF) bulb for a 60 watt incandescent yields the same light output but saves 46 watts. Assuming the bulb is on about 3 hours a day or 1000 hours a year, each CF bulb saves about 46 KWH per year. Using the EPA conversion factor of 0.00069 tons GHG/KWH means that replacing one 60 watt incandescent with one 14 watt CF bulb will save 0.032 tons of GHG yearly. Therefore it would take 100,000 CF bulbs to equal the GHG savings of SMART. If the 37-mile version only has 1198 riders it would take roughy 42,000 bulbs.

Smart vs Hybrid vehicle subsidies:

**********END**********