Transportation Solutions Defense and Education Fund

P.O. Box 151439 San Rafael, CA 94915 415-331-1982

April 10, 2017
Posted to:
scopingplan2030

Mary Nichols, Chair
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Re: Proposed Final 2017 Scoping Plan Update: General Comments

Dear Ms. Nichols:

The Transportation Solutions Defense and Education Fund, TRANSDEF, is an environmental non-profit advocating for the regional planning of transportation, land use and air quality, with a focus on reducing the impacts of transportation on climate change. We have previously submitted extensive comments (attached) on the failure of the draft Updates of the Scoping Plan to seriously address VMT reduction. These general comments on the Proposed Final 2017 Scoping Plan Update ("Update") are submitted together with TRANSDEF's companion letters on VMT reduction, the Environmental Assessment and regional targets. Page references are to the Update unless noted.

We heartily agree with the statement:

> In developing this Proposed Plan, time matters. The policies that are included must lead rapidly to real results to avoid the most catastrophic impacts of climate change. The Proposed Plan identifies policies based on solid science and identifies additional research needs, while also recognizing the need for flexibility in the face of a changing climate.
> (p. 25.)

Transportation Funding

TRANSDEF was very pleased to read the Board's comments about the need to align the state's transportation funding with its climate goals. Because of induced demand, SB 1 highway expansion funding will result in increased VMT and increased GHG emissions. **This funding bill demonstrates the unwillingness of entrenched forces to stop harming the climate** and highlights a point TRANSDEF has consistently made: a profound shift in cultural values is needed before the major funding streams can be shifted to low-carbon transportation modes.

By approving SB 1, the Governor and Legislature have neutralized many of ARB's efforts of to reduce GHGs. They have further delayed the day when California's many levels of government start making coherent decisions to protect the climate.

Achieving Success
We strongly agree that:

> However, to definitely tip the scales in favor of rapidly declining emissions, we also need to reach beyond State policy-making and engage all Californians. (p. 131.)

We think this is the most strategically important statement in the Update, but it is not given the prominence, resources and analysis that it deserves. TRANSDEF urges ARB to lead with this section, and include in it a robust and well-thought-out communications program. It ties in directly with the Board's transportation funding concerns.

Quantification
The inadequacy of the Update is apparent in the very first sentence of the Environmental Assessment:

> This Draft Environmental Analysis (EA) is prepared for the California Air Resources Board's (ARB or Board) consideration of the Proposed Strategy for **Achieving** California's 2030 Greenhouse Gas Target (Proposed Plan). (EA, p. 1, emphasis added.)

Unlike the 2008 Scoping Plan's Table 2, neither the Proposed Final 2017 Scoping Plan Update ("Update") nor the EA presents a quantified demonstration that the recommended Greenhouse Gas Reduction measures **will achieve** the 2030 target. Without a quantified demonstration, it is invalid to claim that:

> this Draft EA serves as a comprehensive, programmatic environmental analysis of the State's recommended GHG reduction measures to reach the 2030 target. (EA, p. 3.)

With its decades of preparing California's SIP, ARB clearly has the technical capability to demonstrate achievement. Table III-1, while a step in the right direction, fails to total those emissions or show how that total correlates with the total GHG reductions needed to meet the targets.

TRANSDEF asserts that the absence of a demonstration that its Update will achieve the targets mandated by AB 32 and SB 32 constitutes a failure to perform a mandatory duty, in violation of both of those statutes. It is a violation of the spirit of AB 32 and SB 32 for a plan that is mandated to achieve GHG emissions reductions targets to not analyze whether it achieves those targets. Separate CEQA thresholds of significance should be set for the failure to achieve the GHG targets mandated by AB 32 and SB 32.

Without a specific numeric emissions reduction goal assigned to each sector, it will be impossible to design or justify a specific package of emissions reduction measures, in those sectors prone to controversy.

TRANSDEF expects neither a crystal ball nor perfection in forecasting--only that ARB commit to providing numeric estimates for emissions reductions, exercising the same professionalism used in SIPs. Because TRANSDEF has no desire to delay the beneficial effects of the Scoping Plan, we would be satisfied with ARB's written commitment to publish within six months the full quantification of the emissions reductions from each of the measures in the Proposed Plan, in conjunction with a further commitment to revise the Update if achievement of the targets cannot be demonstrated.

Please note that TRANSDEF's companion VMT reduction letter points out in detail why the strategies identified in the Update and its attachments are insufficient to produce the desired 45% reduction in transportation GHG emissions. A "15 percent reduction in total light-duty VMT by 2050" (p. 105), for example, cannot be counted as a measure, both because its elements have not yet been defined, and because the potential strategies it relies on are inadequate. Only those measures that have been defined with enough specificity to permit the calculation of an emissions reduction estimate may count in a demonstration.

<u>High-Speed Rail</u>

Neither the Update nor the EA referenced *TRANSDEF v. ARB*, a challenge to the 2014 Scoping Plan's inclusion of High-Speed Rail ("HSR") as a GHG emissions reduction measure.

The Update makes no showing that HSR will achieve:

> the maximum technologically feasible and cost-effective GHG emission reductions by 2020 (Health & Saf. Code, § 38561, subd. (a)). (EA, p. 2.)

In fact, all evidence is to the contrary. Rather than achieve emission reductions before 2020, TRANSDEF has submitted evidence that the project will substantially increase GHG emissions for at least the first twenty to thirty years of operations. There is nothing remotely cost-effective about this project. It receives by far, the largest share of cap and trade funds, yet ARB has done no analysis of its cost-effectiveness.

The Update makes no showing that HSR will help achieve its #1 Project Objective:

> for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions to reflect the 2030 target (Executive Order B-30-15 and SB 32, Statutes of 2016) (EA, p. 10.)

Regional Targets (EA, p. 65.)
One of the reasons for our call for a fully quantified update is our recognition of the failure of the 2010 bottom-up process of setting regional GHG emissions reduction targets by allowing them to be based on MPO suggestions. Because the call for Increased Stringency of 2035 Targets (EA, p. 12) will be politically challenging, there needs to be an overall top-down emissions reduction expectation (like the 5 $MMTCO_2e$ that had been presented in Table 2 in the 2008 Scoping Plan) to work backwards from. That number can only be identified from a rigorously quantified plan.

Innovative Clean Transit (EA, p. 19.)
TRANSDEF believes ARB has harmed the ability of the transit industry to reduce GHG emissions through ARB's narrow focus on the motive power of transit vehicles. We see a substantial shift to transit modes as far more quantitatively important to the emissions of criteria and climate pollutants than is motive power. If innovative clean vehicles are made costly enough to impact the ability to expand service levels, the forest will have been lost in the trees.

More Stringent National Locomotive Emission Standards (EA, p. 20.)
There is no longer any justification for EPA to allow full locomotive remanufacturing to Tier 0 standards, just because some technicality has been met, such as the preservation of the chassis of an outdated locomotive.

Land Use Strategies (EA, p. 27.)
ARB needs to reassert the finding of an extensive body of research, demonstrating that proclivity to use transit falls off sharply after 1/4 mile from a transit stop. The "within ½ mile from transit centers" was brought into legislation by developers that wanted to free-ride on the acknowledged environmental benefits of Transit Oriented Development. The emissions benefits of TOD "within ½ mile from transit centers" is far less than can be extrapolated from TOD within 1/4 mile, and calculations should reflect that.

Alternative 2--Carbon Tax
TRANSDEF strongly supports a carbon tax for California, and looks forward to the expiration of the Cap and Trade program. We object to the staff's analysis of Alternative 2. The Alternatives Analysis is neither fair nor accurate:

> Since the statutory direction on GHG reductions is definitive, the issue of certainty of reductions is paramount, and alternatives vary greatly as to the certainty of meeting the target. The year-over-year reductions under a Cap-and Trade Program, for instance, provide certain and measurable reductions over time; a carbon tax, while putting a price on carbon to be sure, may not be enough to drive reductions by altering behavior." (p. 32.)
>
> A cap-and-trade program sets an emission cap so that the maximum allowable GHG emission level is known and

> covered entities will have to reduce GHG emissions. With a carbon tax, there is no mechanism to limit the actual amount of GHG emissions either at a single source or in the aggregate, and a carbon tax requires entities to pay for all of their GHG emissions directly to the State. In other words, a cap-and-trade program provides environmental certainty while a carbon tax provides some carbon price certainty. There is no emissions limit with a carbon tax. (p. 50.)
>
> A carbon tax has the same inherent flexibility of a cap-and-trade program, with the distinction that without a cap, a carbon tax option may not result in any emissions reductions for GHGs or other air emissions. (p. 59.)

TRANSDEF vehemently disagrees with the claim that Cap and Trade provides certainty. Legal difficulties and legislative renewal difficulties, leading to recent disappointing auction results, demonstrate the exact opposite of environmental certainty. If the Cap and Trade system is itself flawed, as was Europe's, or if it is gamed, it won't achieve its goal.

The drop in the price of natural gas has led to more improvement in air quality and more GHG emissions reductions, due to the shutting down of higher-cost coal-fired power plants, than possibly **any** environmental regulation ever. Market forces are tremendously powerful. If harnessed by a carbon tax with an appropriate escalator mechanism tied to GHG emissions trends, those forces will produce emissions reductions results.

The analysis of the efficacy of the Province of British Columbia's implementation of a carbon tax is deeply misleading on several fronts. BC set more aggressive emissions reduction goals for 2020 than California. (33% below 2007, compared to 15% below 2008 levels, respectively.) BC has already reduced its emissions more than California. The early years of its carbon tax have been a striking success.

BC's Climate Leadership Team has recommended annual carbon price increases going forward. BC has powerfully reduced GHG emissions while having minimal economic effects. This real-world success nullifies the objection that there is no certainty that a carbon tax can control emissions levels. There is no such thing as certainty in life--the very choice of "certainty" as a criterion sets up a false dichotomy.

A tremendous problem with cap and trade is the potential for sophisticated gaming. (Think of how Enron manipulated the California energy market.) A carbon tax, on the other hand, is very straightforward. It should be easy to catch bad actors. Cap and trade requires thousands of lawyers and investment bankers, which add tremendous cost to the emissions reduction process. A carbon tax is simple and inexpensive to administer and does not require an army of lawyers.

Tax proceeds could either be used similar to how the GGRF is used today, or the tax could be made revenue-neutral, by lowering other taxes. Another possibility is to return

the entire proceeds to taxpayers, to offset the increased cost of consumer goods. What's critical here is that current claimants to the GGRF not distort the decision-making process by using their influence to hold onto revenue streams. Opposition from the recipient sector was a major factor in the recent defeat of the Washington state carbon tax initiative.

Conclusion

TRANSDEF recognizes the difficulties faced by ARB in leading the charge towards low-carbon lifestyles. Now is the time to be bold and exercise leadership, especially when the incoming federal Administration denies the need for action against climate disruption. We implore the Board to direct staff to fill in the information and communications gaps identified herein, to educate the public and generate the public support needed to move California's institutions into the climate-supportive category.

Sincerely,

/s/ DAVID SCHONBRUNN

David Schonbrunn,
President
David@Schonbrunn.org

Letter 2

Transportation Solutions Defense and Education Fund

P.O. Box 151439 San Rafael, CA 94915 415-331-1982

April 10, 2017
Posted to:
scopingplan2030

Mary Nichols, Chair
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Re: Proposed Final 2017 Scoping Plan Update: VMT Reduction

Dear Ms. Nichols:

The Transportation Solutions Defense and Education Fund, TRANSDEF, is an environmental non-profit advocating for the regional planning of transportation, land use and air quality, with a focus on climate change. We have submitted extensive comments on the failure of the draft Updates of the Scoping Plan to seriously address VMT reduction.

The Proposed Final 2017 Scoping Plan Update[1] ("Update") won't work. It neither offers specific measures to proportionally reduce transportation's contribution of nearly half the state's GHG emissions, nor does it propose measures that are likely to be effective in doing so. While it would not be technically difficult to put together such a plan, approving it would be politically challenging. Nonetheless, wishful thinking is not a substitute for planning, especially when the purpose is to avert climate catastrophe.

We heartily agree with the statement:

> In developing this Proposed Plan, time matters. The policies that are included must lead rapidly to real results to avoid the most catastrophic impacts of climate change. The Proposed Plan identifies policies based on solid science and identifies additional research needs, while also recognizing the need for flexibility in the face of a changing climate.
> (Update, p. 25.)

As regards VMT reduction, however, we see that ARB has abandoned this approach, apparently as a result of political considerations. Reducing VMT will involve profound changes to the culture of this heavily auto-dependent state. This difficult work has been pushed off into the indefinite future, contrary to the policy statement cited above. This is

a violation of the public's trust in your agency, and of its statutory mandate. ARB must be a truth-teller, especially when that truth is inconvenient.

The success of the Scoping Plan Update will ride on whether ARB's goal, a 45% reduction in transportation GHG emissions (2016 Mobile Source Strategy),[2] can be accomplished by 2030.

> The scenario assumed a 15 percent reduction in total light-duty VMT in 2050, compared to baseline 2050 levels. **This would translate into light-duty VMT growth of only five percent by 2030**, compared to current growth rates of approximately 11 percent. (*Id*., p. 37, emphasis added.)

This statement, due to its critically important policy implications, needs to be prominently featured in the Update, with clarification as to the base year and whether this is an annual or aggregate growth rate. **This calculation should be the measure by which each of the state's efforts in the transportation sector is evaluated**.

The Update and/or its Environmental Assessment[3] sorely lacks a chart listing the VMT projections of all of its various county and regional jurisdictions, along with a statewide aggregation, and comparing that to the Vision Scenario plans in the Mobile Source Strategy. (p. 36.) Numbers are needed for groundtruthing.[4] Without actual numbers, any discussion of VMT reduction strategies will be so vague as to be meaningless.

> Over the last 60 years, development patterns have led to sprawling suburban neighborhoods, a vast highway system, growth in automobile ownership, and under-prioritization of infrastructure for public transit and active transportation. Local decisions about these policies today **can** establish a more sustainable built environment for the future. (Update, p. 27, emphasis added.)

The evidence so far, however, is that, despite ARB's best efforts, local decisions favor more of the same, resulting in continued VMT growth. According to the Federal Highway Administration, California's VMT in July and August 2016 was more than 6% higher than in 2015. Without strong requirements handed down by the state, there is no reason to believe local decisions will change.

We are struck by the Update's blithe inclusion of a "15 percent reduction in total light-duty VMT in 2050." (Update, p. 105.) The 5% growth limit cited above implies a 50% reduction in VMT growth by 2030. As we have written previously, there is nothing in the "Potential State-Level Strategies"[5] ("Strategies") paper that could achieve such an overall reduction. Here are a series of reasons why there is ZERO possibility the Strategies will achieve the desired reduction:

- The recent approval of SB 1 will provide billions of dollars for highway expansion in the guise of congestion relief. Induced demand will significantly increase VMT.

- There is no state-level leadership educating the public about the relationship between personal mobility and climate change, and inspiring Californians to consider lower-carbon lifestyles. Without this kind of leadership, the cultural change implicit in reducing VMT will be politically impossible. With leadership and education, the public may be persuaded that changes in daily driving behavior are worth making for the sake of our children and grandchildren.
- The Strategies ignore the tremendous inertia of BAU transportation policies and the powerful political influence of entrenched interests. Current transportation capital and operating funding patterns continue to focus on highways and so-called congestion relief, despite ARB-funded research pointing to the futility of such spending.[6] The leadership in the Legislature seeks to continue the funding priorities of a pre-climate change era (SB 1). That continuation of status quo funding will fuel the growth in VMT, and starve the development of convenient alternative modes of travel that are essential to effective climate change mitigation.
- Despite all of ARB's work on climate, congestion management agencies adopting sales tax expenditure plans continue to act like they've never heard of SB 375 or climate change. The Strategies is silent on how sales taxes now make up roughly half of all transportation funding in the State, making it critical for the State to establish a legal framework where sales taxes must be consistent with State policy, focused on VMT reduction rather than "relieving congestion."
- The county where TRANSDEF is located, for example, is planning to seek a sales tax increase for transportation, based on polling residents on what they are willing to pay for. Polling will necessarily come up with answers that increase rather than reduce VMT, because residents are primarily concerned with the congestion that affects their daily lives, and don't understand the bigger picture.
- The Strategies is silent on a huge unanswered question in transportation: "When will agencies finally have to set aside their backlogs of capacity-building projects, and get with the climate change program?" Regional agencies use Committed Projects policies ("If it was in the last RTP, we don't reevaluate it--it automatically goes into the next RTP") as a means of locking in the status quo.
- In short, there is no commitment in county transportation planning to addressing the climate emergency--local agencies expect the State to do all the heavy lifting.
- The Strategies' approach to project selection is hopelessly naive: "Explore development and adoption of additional performance measures and targets to inform the selection of transportation capital projects." (Strategies, p. 2) Influence over project selection is one of the biggest political plums of elective office. Until project selection can be brought into alignment with state climate goals, VMT growth will continue to be out of control.
- Other problems with the Strategies paper are identified in TRANSDEF's September 2016 letter to ARB, attached.
- All together, these points identify the need for profound cultural change, for which ARB has yet to demonstrate an appetite.

TRANSDEF believes it is inappropriate for the VMT Reduction Strategies to be counted as "Known Commitments" (Update, p. 35) and be evaluated for their GHG emissions reduction potential, when they have yet to be adopted or even proposed. These Strategies were not part of the Project Description in the Environmental Assessment, and thus cannot be considered environmentally cleared, or part of the Update.

No state agency has yet articulated a consistent low-carbon pathway forward for transportation. TRANSDEF urges ARB to frame up a coherent policy on achieving VMT reduction, consistent with the quotations from its plans included herein, as Caltrans is not willing to do so. (A culture war is underway at Caltrans, and the BAU side is currently winning. See CTP 2040 section of attached comment letter.)

The Inherent Conflict Between Advanced Clean Vehicles and VMT Reduction

While we are enthusiastic EV supporters, we recognize that the state is challenged by two distinct transportation problems: the need for a large reduction in GHG emissions from motor vehicles, and peak-period congestion in metropolitan areas. Local transportation agencies have been focusing on clean vehicles as their primary method of reducing GHGs, as a means of avoiding their responsibilities to reduce GHGs by implementing the systemic changes called for by SB 375.

TRANSDEF supports the phasing-out of clean air vehicle access to HOV lanes, so that this critical resource may be used exclusively to promote carpool and transit vehicle use by offering a consistent travel time advantage. A focus on mode choice, rather than vehicle motive power choice, will result in a far larger amount of emissions reductions.

Our solo-driving-based transportation system cannot cope with mass numbers of travellers. Peak-period travel is inherently different from off-peak travel: by its very nature, peak-period travel is mass transportation. While EVs are an excellent and fast solution for the GHG challenge, overly focusing on them would exacerbate the congestion problem. As long as population growth means more cars, California will continue the trend of increasing VMT and increasing congestion.

Conclusion

TRANSDEF recognizes the difficulties faced by ARB in leading the charge towards low-carbon lifestyles. Now is the time to be bold and exercise leadership, especially when the incoming federal Administration denies the need for action against climate disruption. We implore the Board to direct staff to propose goals and a menu of programs that will arrest California's increasing VMT, and lead to meaningful reductions in the near-term.

Sincerely,

/s/ DAVID SCHONBRUNN

David Schonbrunn,
President
David@Schonbrunn.org

Attachment
TRANSDEF September 2016 Comment Letter to ARB: Comments on Potential State-Level Strategies to Advance Sustainable, Equitable Communities and Reduce Vehicle Miles of Travel (VMT).

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[1] Proposed Final 2017 Scoping Plan Update, ARB, https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf (accessed 2/27/17)
[2] 2016 Mobile Source Strategy, ARB, p. 29, http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm (accessed 2/27/17)
[3] Scoping Plan Draft Environmental Assessment, ARB https://www.arb.ca.gov/cc/scopingplan/app_f_draft_environmental_analysis.pdf (Appendix F, accessed 2/27/17)
[4] We note, for example, our skepticism as to the 11% growth number cited above. We observe that multiple counties have recently approved transportation plans showing 28% increases in VMT by 2040.
[5] Part of: Vibrant Communities and Landscapes and Potential VMT Measures, ARB, https://www.arb.ca.gov/cc/scopingplan/app_c_vibrant_comm_vmt_measures.pdf (Appendix C, accessed 2/27/17)
[6] Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions, Susan Handy et al, http://www.arb.ca.gov/cc/sb375/policies/hwycapacity/highway_capacity_brief.pdf (accessed 2/27/17)

Attachment

Transportation Solutions Defense and Education Fund

P.O. Box 151439 San Rafael, CA 94915 415-331-1982

September 26, 2016
Posted to:
scoplan2030trnspt-ws

Mary Nichols, Chair
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Re: Comments on Potential State-Level Strategies to Advance Sustainable, Equitable Communities and Reduce Vehicle Miles of Travel (VMT).

Dear Ms. Nichols:

The Transportation Solutions Defense and Education Fund, TRANSDEF, is an environmental non-profit advocating for the regional planning of transportation, land use and air quality, with a focus on climate change. We consider reducing VMT to be our primary mission. We strongly support ARB's efforts to design programs to achieve the state's GHG emissions reduction targets. We are proud that California wants to demonstrate to the world how to do it. We hope you find our outsider perspective as real-world transit advocates useful as you update the Scoping Plan.

We attended the public workshop on the Transportation Sector to Inform the 2030 Target Scoping Plan Update, and reviewed the Potential State-Level Strategies to Advance Sustainable, Equitable Communities and Reduce Vehicle Miles of Travel (VMT). While our comments primarily address that document, we also make comments on ARB's overall transportation strategy and incorporate by reference our 2015 comments on the Scoping Plan Update to Reflect the 2030 Target, as they are still entirely relevant. They are available at: https://www.arb.ca.gov/lists/com-attach/3-2030targetsp-ws-WmgCNFdnA2VSCwZz.pdf

The Paper's Fundamental Premise is Untrue

The frame for the paper is the presentation of potential additional strategies to reduce VMT. This necessarily implies the existence of effective strategies already in place. In reality, while the rhetoric of state and regional agencies now call for a reduction in VMT, their actual decisions--and especially their funding priorities--are still firmly stuck in the highway-focused mentality of the last century. The vast majority of funds allocated by the CTC goes to highways, and are likely to induce additional VMT. Many local jurisdictions reject any responsibility whatsoever for VMT, even in their rhetoric. (See 2015 comment letter.) The results to date of the highlighted existing strategies (SCS--

the other two have not even been implemented) are minimal at best. Local and regional plans continue to show sharply increasing VMT.

Twenty-five years ago, the State of Oregon adopted its Transportation Planning Rule, which directed its localities to better connect land use plans with transportation plans. That law, and its implementation, was highly successful. Oregon now has a significantly lower VMT per capita than the rest of the U.S. Until California does something far-reaching like that, VMT will continue to increase with population.

TRANSDEF fully recognizes how controversial an effective program to reduce VMT will be. We surmise that the current dismal state of affairs in VMT reduction policy is the result of high-level decisions to avoid controversy. This "Potential State-Level Strategies" paper is clearly the product of such decisions, as it fails to propose any impactful strategies to reduce VMT, despite knowing what would work. It is curious that the senior agency officials that signed off on this paper publicly support VMT reductions while privately opposing the very policies that would actually accomplish them.

As environmentalists working for decades to reduce VMT, we would prefer candor from those officials, in the recognition that, essentially, this is an education problem. Most of the population continues to believe in the traffic fairy: If only we support the next sales tax or bond measure, the traffic fairy will make traffic congestion vanish. The public needs to be educated--by leaders it respects--that the time is coming to a close when it is possible in metropolitan regions for most residents to commute by solo driving.

Because the Potential Strategies paper does not confront this central problem of transportation, adopting the paper as-is into the Updated Scoping Plan will prevent the State from controlling its largest GHG emissions category, motor vehicles. A failure to control VMT almost certainly means a failure to achieve AB 32 and SB 32 goals.

Increasing Infill Development

The State needs to create a fundamental economic advantage for infill development, if it is serious about achieving results. Auto-dependent development--sprawl--should be strongly disincentivized by a stiff impact fee based on added VMT. This could possibly be structured as an indirect source mitigation fee. The fee needs to be high enough to take the profit out of sprawl development. (This is entirely equitable, since much of the profit in the sprawl business model comes from externalizing the cost of access.) The playing field for infill development needs to be more than just level--it needs to be tilted towards infill, to compensate for its inherent difficulties.

Adoption of legislation modeled on Oregon's Transportation Planning Rule would help Shift land use practices in a sustainable direction.

Infrastructure Investments

The fundamental problem in infrastructure is not "identifying and prioritizing projects." The problem is that transportation funding has long been a preferred vehicle for conferring political benefits. Projects consistently get funded not because of their merits, but because of their sponsors. This wastes vast amounts of scarce public capital. Until

that capital can be focused on the transit infrastructure needed to provide convenient alternatives to solo driving, VMT reduction will not happen. This will require a change in the expectations of politicians as to the scale of favors they are able to confer on their benefactors.

The paper's proposals for increasing transit mode share are not going to result in significant mode shift unless there is a sea change in where the bulk of the Stat's transportation funds are spent. The infrastructure section of the paper will not benefit VMT reduction unless its first policy is to eliminate funding for projects that increase VMT.

This writer is currently traveling in Switzerland, a country that has invested intensively in its rail infrastructure. It appears possible to get to anywhere in the country without a car. None of this is complicated or even all that difficult, once the political realization dawns that mobility in metropolitan regions primarily reliant on the automobile can only continue to decline. Switzerland, for example, has a unique investment-prioritizing process, which consistently seeks to optimize system performance by strategic incremental improvements.

Driverless Cars

It is understandable that desperate transportation planners would latch onto autonomous vehicle technology as a life raft in response to the sinking ship of auto mobility. However, they miss a glaring problem: making it easier for anyone, of any age, to "drive" solo will inevitably greatly increase VMT. Roadway congestion (and GHG emissions, supposedly) are the only limiting factors to the explosion of this technology.

The thought process behind "Continue to study and develop policies around driverless vehicle technology that promote sustainable and equitable land use and reduce VMT" Is completely backwards. Because the technology was developed to foster independent travel, it encourages unsustainable sprawl development. This section needs to be totally rewritten to express concern about the great harm this technology will do to the State's sustainability policies.

As an example of clear thinking on this technology, see: http://humantransit.org/2015/11/self-driving-cars-a-coming-congestion-disaster.html

Pricing

Yes, it's true that "Several extensive studies have found pricing to be among the most impactful long-term VMT and GHG reduction strategies for the transportation sector." Despite the fact that the Potential State-Level Strategies paper has no other impactful strategies to offer, it baulks on proposing any serious pricing (it's all study this and explore that...). All-lane highway pricing would do more for VMT reduction than anything else in the paper. If we recognize that highway congestion is the simple laws-of-supply-and-demand result of many decades of underpricing, it should be obvious that gradually increasing pricing will correct the market distortions over time.

It is equally obvious that pricing is politically terrifying. If we are at all serious about VMT reduction, we will inevitably end up having to deal with bringing the public along in implementing pricing, so why not start the discussion now? TRANSDEF advocated for two decades on the need to build convenient cost-effective transit, so that alternatives will be in place to give road users a choice of mode when pricing commences. MPOs like MTC have maximized the difficulty of a transition to a pricing regime by refusing to commit their resources that way. They were instead focused on policy disasters like Express Lanes.

Express Lanes are a Strategy to Increase VMT

By providing facilities for solo drivers to avoid congestion, Express Lanes encourage the very behavior this paper's strategies are meant to discourage. It would be hard to find a worse strategy for reducing VMT than "Develop additional highway express lanes" unless it would be to make this the top pricing strategy.

HOT lanes are an artifact of the capacity-is-everything mindset of the previous century. The myopia of that mindset, which sees solo driving as the basic module of transport, prevents its practitioners from recognizing that solo driving is the fundamental problem of transportation. Instead of the old way, contemporary planners need to see solo driving as a failure of community design.

High-Speed Rail

We incorporate by reference our oral and written comments and attachments on the 2014 Scoping Plan Update. In those comments, we provided evidence that the HSR project currently underway will result in a net increase in GHGs that will last through at least two decades of operations. ARB failed to independently review CHSRA's GHG analysis, resulting in the Chair endorsing a deeply flawed analysis. TRANSDEF is currently in litigation on this matter with ARB.

In short, unless HSR can be conclusively demonstrated to reduce GHGs in the long and short term, using comprehensive life cycle analysis methodologies, it cannot be included in the updated Scoping Plan as a GHG emissions reduction measure.

CTP 2040

The recently adopted California Transportation Plan 2040 failed to meet the legislative mandate of SB 391. (See TRANSDEF comment letter on the Draft CTP Guidelines, available at: http://www.dot.ca.gov/hq/tpp/offices/osp/ctp_files/comments/4DavidSchronnbrunn_Transdef.pdf) Perhaps the single most important action ARB can take to reduce VMT is to arrange for all State agencies to rescind their approvals of the Final Draft CTP 2040, and adopt the first public Draft CTP 2040 instead. That document did far more than "address" the 80% GHG reduction called for by law--it provided recommendations on how to get there.

Conclusion

TRANSDEF recognizes the difficulties faced by ARB in leading the charge towards low-carbon lifestyles. We appreciate this opportunity to comment on the Update to the Scoping Plan. We would be pleased to assist in the implementation of these ideas.

Sincerely,

/s/ DAVID SCHONBRUNN

David Schonbrunn,
President
David@Schonbrunn.org

Letter 3

Transportation Solutions Defense and Education Fund

P.O. Box 151439 San Rafael, CA 94915 415-331-1982

April 10, 2017
Posted to:
scopingplan2030

Mary Nichols, Chair
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Re: Proposed Final 2017 Scoping Plan Update Environmental Assessment

Dear Ms. Nichols:

The Transportation Solutions Defense and Education Fund, TRANSDEF, is an environmental non-profit advocating for the regional planning of transportation, land use and air quality, with a focus on climate change. This letter incorporates by reference companion TRANSDEF's letters on the Proposed Final 2017 Scoping Plan Update and its VMT reduction approach (both submitted April 10, 2017), and 2017 Regional Targets (submitted March 22, 2017), **all of which raised significant environmental issues despite not specifically addressing the Environmental Assessment** ("EA"). All page number references are to the EA unless otherwise noted.

<u>High-Speed Rail</u>
Neither the EA nor the Update references *TRANSDEF v. ARB*, a challenge to the inclusion of High-Speed Rail ("HSR") in the 2014 Scoping Plan. With a decision pending in that case, and with HSR included as a measure in the Update, we reiterate our CEQA assertions here:

1. Under Impact 8.a, **the EA failed to identify as significant impacts the GHG emissions resulting from the very large amounts of construction materials to be used by the HSR project.** Rather than achieve emission reductions before 2020, TRANSDEF has submitted evidence (attached) that the project will substantially increase GHG emissions for at least the first twenty to thirty years of operations. The HSR project precisely fits the definition of an atypical project that requires a detailed analysis:

> GHG analyses focus on operational phase emissions, as discussed below, unless the project is of a unique nature requiring atypical (e.g., large scale, long-term) construction activity levels (e.g., construction of a new dam or levee) for

> which quantification and consideration (e.g., amortization of construction emissions over the lifetime of the project) may be recommended. (94.)

2. As acknowledged in the 2014 Scoping Plan, the project will not operate service until 2022 at the earliest. For that reason, and for the ones following, the project has thus changed since it was evaluated in 2008, requiring a new review of its emissions impacts.

> Where applicable **and still valid**, information and analysis are drawn from these prior environmental documents for use in this Draft EA. (3, emphasis added.)

In the Final 2016 Business Plan, CHSRA's Peer Review Group states (p. 117) that "[T]he Authority is acknowledging that there are not sufficient existing funds to complete the southern leg [the connection from Bakersfield to Los Angeles]..." Thus, there is no longer evidentiary support for most of the claimed emissions reductions. See: http://www.hsr.ca.gov/docs/about/business_plans/2016_BusinessPlan.pdf

Even if CHSRA provides interim bus service over the Tehachapis until funding is somehow located, there is no evidence to support the claimed ridership from L.A. to S.F. (or even to San Jose) under this plan, nor have the GHG emissions associated with bus service been analyzed. They are likely to more than offset any GHG emissions reductions associated with the HSR service.

See TRANSDEF comment letter on CHSRA 2016 Business Plan, attached.

3. After identifying the significant impact of construction GHG emissions, correcting the three excerpts of text below, and replacing the overly vague bold text below with a quantification, the most feasible and appropriate mitigation would be avoidance: Eliminate the HSR project as a measure in the Scoping Plan.

> Overall, the Proposed Plan would result in substantial long-term GHG reductions, although certain aspects of the Proposed Plan would cause **comparatively small** short-term GHG emission increases. (94.)

> Therefore, construction-related GHG emissions are expected to be short-term and limited in amount. (94.)

> Implementation of the Proposed Plan would result in environmental benefits that include an estimated reduction in GHG emissions. These benefits would be greater than a comparatively small level of GHG emissions related to construction and operation of facilities associated with the compliance responses, as described above. (95.)

Regional Targets (65.)
The EA recognized that MPO strategies to reduce congestion (by widening highways) can have adverse impacts on criteria pollutants:

> ...there may be some increases in localized exposure to TACs. For example, improvements to existing facilities identified in an RTP/SCS (e.g., road widenings, intersection or interchange improvements... (65.)

However, it failed to acknowledge the impact of induced demand: increased capacity leads to increased VMT, which leads to increased GHG emissions, a CEQA impact. Please revise the EA accordingly.

Even though the Environmental Assessment (EA) is a program-level analysis, it should be apparent that any program that adds new lanes for single-occupancy vehicles will, through induced demand, result in an increase in VMT and therefore, GHG emissions. It is therefore entirely appropriate, and critical for programmatic GHG emissions reduction, for the EA to find significant adverse GHG emission impacts resulting from the inclusion in the Plan of the following proposals in Appendix C, Potential State-Wide Strategies to Reduce Vehicle Miles Travelled:

- Develop additional highway express lanes under the authority of AB 194 that offer access to high-occupancy vehicle lanes to single occupant drivers willing to pay a toll, with related revenue supportive of road maintenance and improving multi-modal travel options on the corridor. (Appendix C, p. 4.)
- Explore creation of additional high-occupancy vehicle (HOV) and high-occupancy toll (HOT) lanes. (Appendix C, p. 5.)

Neither the additional revenue generated by HOT lanes, nor the fee charged solo drivers will adequately mitigate the increased GHG emissions impact of HOT lanes. The appropriate feasible mitigation for this impact would be avoidance, by deleting this text from Appendix C and identifying in the Impact.8a section that allowing solo drivers to access HOV lanes will create the significant impact of increased VMT and GHG emissions, because of the effect of induced demand.

With the new transportation funding for highway expansion in SB 1 just approved, a mitigation measure is especially needed: Avoidance of the impact is the preferred mitigation, by barring solo drivers from HOV lanes. TRANSDEF believes such an action is required by ARB's mandate, because transportation is the state's number one emissions sector:

> Consider, to the extent feasible, the contribution of each source or category of sources to statewide emissions of GHGs (Health Saf. Code §38562, subd.(b)(9)) (11.)

SB 375 was intended to reduce regional emissions by changing how future transportation and land use projects interact:

> Overall, MPOs are expected to meet new targets through actions that would reduce VMT... (65.)

While that may be ARB's expectation, it is not working out that way in practice. MTC's 2017 Final Preferred Scenario presentation for its Sustainable Communities Strategy stated that:

> Most of the Plan's GHG emission reductions will come from MTC's Climate Initiatives Program. **Transportation and land use strategies are not enough to meet the climate goals of SB375**, requiring the following additional programs: Transportation Demand Management, Alternative Fuel/ Vehicle Strategies, and Car Sharing and Vanpool Incentives. (Slide 19, emphasis added, http://mtc.ca.gov/sites/default/files/Final Preferred Scenario POWERPOINT.pdf)

Please revise the EA accordingly.

Autonomous Vehicles

TRANSDEF's comments on previous versions of the Scoping Plan presented a Jarrett Walker article suggesting that autonomous vehicles will result in increased congestion and VMT. For that reason, we disagree that the assertion that autonomous vehicles necessarily offer emission benefits:

> ... and emission benefits associated with increased transportation efficiencies, as well as the potential for autonomous vehicles and advanced transportation systems. (18.)

In addition, as transportation practitioners, we have no idea what is meant by "advanced transportation systems."

In addition, TRANSDEF believes the following description from the Strategies paper, Appendix C:

- Continue to study and develop policies around driverless vehicle technology that promote sustainable and equitable land use and reduce VMT. (Appendix C, p. 3)

to be a null set, in that there cannot be driverless vehicles that reduce VMT. At least two reasons why: Driverless vehicles enable individual mobility for the young, old and disabled, thereby increasing person-trips. Driverless vehicles would be travelling between trips for customers, thereby adding additional trips.

Transportation Demand Management (27-28.)
Allowing access to managed lanes by toll-paying solo drivers will increase regional VMT and GHGs, rather than reduce them. The EA should note this as an impact, and calculate emissions reductions accordingly.

Mitigation of Transportation Impacts (144-145.)
The EA is legally incorrect in suggesting that:

> Potential impacts on transportation and traffic could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of ARB and not within its purview. (144, with analogous statement at 148.)

It is ARB's duty under CEQA to identify those impacts, and place the mitigation responsibility on the project sponsor in a statement of overriding considerations. In addition, It is within ARB's authority and purview to mitigate these impacts by limiting eligibility of grants of GGRF and other funds to only those jurisdictions that fully mitigate their projects' climate impacts.

ARB's statewide scope makes the Scoping Plan an especially appropriate place to call attention to the possibility that the congestion impacts of the construction of transportation projects can easily outweigh the time-savings benefits of some projects.

The EA asserts that:

> ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions." (145.)

This is incorrect. ARB has the authority to enact Indirect Source Mitigation Fees on new development as mitigation of a variety of impacts, which could be highly effective in changing the economic incentives in favor of infill projects, by removing the windfall profits from greenfield construction, which typically does not mitigate its transportation impacts. TRANSDEF formally proposes indirect source mitigation fees as a feasible mitigation for the VMT-increasing impacts of greenfield development, which lead to increased GHG emissions and regional traffic congestion.

As was stated above in reference to Appendix C, a mitigation measure should be included in the Impact 17.b (and 8.a) sections, Operational Impacts to Traffic and Transportation, to avoid the impact of increased VMT and GHGs, to not open HOV lanes to solo drivers.

Publication Issues
The EA does not list its mandatory findings of significance (169-171). It is not adequate to merely make reference to other EA Chapters.

The Table of Contents (i) is insufficiently detailed, presenting over 110 pages of impact analyses in Chapter 4 without any entries. This prevents researching a specific impact.

Conclusion

TRANSDEF appreciates this opportunity to suggest improvements to the Environmental Assessment.

Sincerely,

/s/ DAVID SCHONBRUNN

David Schonbrunn,
President
David@Schonbrunn.org

Attachments

TRANSDEF comment letter on 2016 CHSRA Business Plan, with attached TRANSDEF Analysis of CHSRA GHG paper, and Chester and Horvath study.

Attachment

Transportation Solutions Defense and Education Fund

P.O. Box 151439 San Rafael, CA 94915 415-331-1982

April 18, 2016
By E-Mail to:
2016businessplan
comments
@hsr.ca.gov

Dan Richard, Chair
California High-Speed Rail Authority
770 L Street, Suite 620 MS-1
Sacramento, CA 95814

Re: Draft 2016 Business Plan

Dear Mr. Richard:

The Transportation Solutions Defense and Education Fund, TRANSDEF, is a non-profit environmental group dedicated to the regional and interregional planning of transportation, land use and air quality. Our focus is on reducing GHG emissions from transportation. TRANSDEF has long been actively involved in HSR, starting with commenting on the Draft Statewide EIR in 2004. We have been a party in all three *Town of Atherton* EIR challenges and the appeal. We continue to be conceptually supportive of HSR, but do not believe the CHSRA's project can be economically viable--or even can be built--due to its being designed to meet priorities other than transportation.

With this Draft Business Plan, the Authority has pretty much admitted there is no way it can build to Southern CA. The $3.2 billion in projected monetization from the IOS (p. 64) is only a tiny fraction of the cost to complete Phase 1. With no likely sources of additional funding, the situation is grim. This moment requires courageous truth-telling and owning up to past mistakes. This Draft Plan is not that.

The Draft Business Plan repeatedly mentions bringing in the private sector early in the design process. That is what the Peer Review Group recommended. But it is not what was done. The private sector was not brought in for the most critical part of the design: route selection. The reason there is no private money in this project now is because the politically selected route is a money-loser. (Rail operators won't say that publicly for fear of retaliation.) HSR in California could be a moneymaking business if the route is optimized for operating profits, but political considerations and private interests have been foremost ever since CHSRA was formed. The public interest has been subverted.

TRANSDEF urges the Authority to consider the analysis contained herein, and put the project on hold. We continue to believe that the way forward is a Request for Proposals

that invites the private sector to propose their own route, environmentally cleared at State expense. A private sector-led project would have a completely different dynamic, and could potentially secure consensus support in the Legislature and Congress. If the drawdown were to stop immediately, Congress might be willing to reinstate the unused portion of the ARRA grant to a private sector-led project.

We note with dismay the Authority's overt contempt for the public. The complete irrelevance of public comments is evident in its announced adoption date for the Final Business Plan three days following the close of the comment period. We hereby incorporate by reference the 4/18/16 comments of the Train Riders Association of CA.

Initial Operating Segment

It did not help the Authority's flagging public support to put forward an IOS with a southern terminus in an orchard in Shafter. That decision led to news stories on The Train to Nowhere that wrote themselves. While the Chair has indicated that the Final Business Plan is likely to have a different terminus, the executive that signed off on the decision to put it in the draft deserves to be reprimanded for exceedingly poor judgment.

Greenhouse Gas Emissions

TRANSDEF produced an in-depth analysis of the 2013 GHG Emissions paper by CHSRA. (See Attachment 1.) It found many flaws, most notable of which was the failure to include the life-cycle emissions of the construction materials, especially concrete. TRANSDEF filed suit to challenge the Air Resources Board's inclusion of HSR as a GHG emissions reduction measure in the first update to the Scoping Plan. In addition, the suit asks the court to invalidate the appropriation of revenues from the Greenhouse Gas Reduction Fund to HSR. CHSRA is a Real Party in Interest in that case.

On the basis of evidence submitted to ARB (See Attachment 2), TRANSDEF concludes that HSR will be a net GHG emitter for at least the first twenty to thirty years of operations. It makes no sense to use the GHG Reduction Fund to build something that won't reduce GHGs for a long time to come. AB 32 recognized the need to get reductions early, when it can slow down movement towards the tipping point. That's when new feedback loops kick in and catastrophic climate change will become unstoppable.

Six years later, it is time for CHSRA to produce a credible GHG emissions analysis that considers all emissions related to the IOS (because that is the only part of the project that is claimed to be funded), using the ridership cited in the Business Plan. (Parenthetically, TRANSDEF notes its inability to suspend disbelief as to the projected ridership for the IOS. See discussion below.) The analysis should specifically determine which year of operations of the IOS the net GHG emissions will become negative. The study should be conducted by an identified author with appropriate credentials for the task.

Until we are convinced by a credible study, TRANSDEF will continue to assert that the current HSR project will be a net GHG emitter if built, and therefore should not receive cap and trade funds. Without cap and trade funds, it cannot access bond funds, making the project infeasible.

Ridership

The ridership projection from San Jose to the Central Valley seems unreasonably high, at about twice recent San Joaquin Amtrak annual ridership, for a trip that is significantly more expensive. It seems unlikely the market can support the pricing expected for HSR. If the projections based on stated preference surveys are to be believed, the documentation needs to confirm that the survey specifically asked about taking an HSR trip from San Jose to Fresno and a bus to Los Angeles. Asking about an HSR trip to Los Angeles would be irrelevant for projecting IOS ridership.

A brand new marketing direction is offered in this Business Plan: HSR is good for commuting to jobs in the Silicon Valley. This is laughable: The projected $63 fare each way is not feasible for commuters, especially for people that are commuting because they can't afford to live in the Bay Area. And it is beyond ludicrous to use cap and trade funds to facilitate the construction of sprawl, which greatly increases GHG emissions. The 2005 Statewide FEIR had an inadequate treatment of growth inducement. It offered no meaningful mitigation measures such as incentives to local jurisdictions to make their future land use patterns compact. Disincentives to continued sprawl would be needed if the long-time pattern is to change. There is no legal basis to expect that "effective land use and transit-oriented development" (p. 46) will replace generations of sprawl.

Capital Costs

Public trust of CHSRA's reporting of capital costs hit a new low following the revelation of the secret PB memo. The attempt at damage control was not at all convincing. It appears to informed members of the public that impending large cost increases have been held back. Meanwhile, at least some of the reduction in Phase 1 cost estimates are the result of scope reductions, of which the $1.5 billion reduction in funding for the Caltrain Downtown Extension is the most evident. Because it is a large enough number to be identified, but was not called out in Figure 1 of the Capital Cost Basis of Estimate Report, it appears that the $5.5 billion in cost reductions is actually a net figure, masking cost increases in certain SCCs or sections.

TRANSDEF suggests that a productive way to repair the public's trust in the project and its management would be to release a master spreadsheet (in .xlsx electronic format) as a supplement to the Capital Cost Basis of Estimate Report. It would tracks the cost estimate for each project segment (identified by specific mileposts) through each of the various Business Plans, starting with 2012. Each item for each Business Plan should have a quantity and a unit cost. That way, it will be possible to see exactly what changes from Plan to Plan. In addition, it should be a working spreadsheet with formulas, including those for updating costs for inflation. This would make it possible to verify that the 2014 Business Plan capital costs were in fact the 2012 Business Plan costs, with an inflation adjustment. A thoroughly informative spreadsheet would clarify such things. Where significant changes occur, it would be helpful to have notes keyed to the cells. A dramatic change in the degree of transparency might make the project more credible.

Funding

While the 2016 Draft Business Plan appears to demonstrate the needed full funding for the IOS, that funding is a mirage. It relies on cap and trade funding all the way out to 2050. The expectation is to raise $5 billion in bonds that are secured by the cap and trade revenues between 2025 and 2050. Those revenues are so speculative that it seems highly unlikely that money on that scale can be raised. Even if it can be raised, it would be very costly, as it would be treated as a junk bond.

It will also take several acts of the Legislature that are bound to be highly controversial: extending the life of cap and trade, putting funds into reserves to pay back the bonds, and pledging considerably more than HSR's 25% share of the funds. Without all the projected cap and trade funds, no pre-expenditure funding plan can qualify for bond funds. Without bond funds for construction, the HSR project cannot proceed. CHSRA will have to go out of business once the federal grant is spent.

Bookends

Bond funding for local projects in the north and south, known as the Bookends, cannot be released for construction. These projects include such projects as Caltrain electrification and grade separations in Southern California. Despite the Legislature having appropriated bond funding for them, they do not qualify for construction funding. To get the funding, a project would have to be part of a fully funded and environmentally cleared segment that will result in infrastructure that is HSR-ready and whose operations will be self-supporting financially. The Bookends can't pass these tests.

Urban Areas

In his April Senate Committee testimony, Chair Richard said trains would go 120 MPH through urban areas, presumably to lower the noise emitted by trains. However, it won't be possible to make the required travel time at that speed. Please show how you can keep the speed down and the speed up at the same time. Contrary to a statement made by HSRA communications staff, San Jose is not the heart of Silicon Valley.

Comments on Specific Pages

4. Where is the information on the estimated capital costs for each segment of the statewide high-speed rail system under PUC 185033(b)(1)(A)?

9. Cap and Trade funds are placed in the Greenhouse Gas Reduction Fund. They are not Greenhouse Gas Reduction Funds.

10 & 11. Cost estimates are not directly comparable. Some lower cost estimates are the result of downscoping. e.g., Elimination of $1.5 Billion contribution to DTX.

12. Please provide ridership breakout by destination to enable evaluation of the significance of commuter traffic, the credibility of the long-distance estimates and the potential impacts of induced sprawl.

12. Investment of public dollars may be the predicate for private sector investment, but without private sector involvement in route selection, the risk is too high that the private sector will never get involved, leaving a stranded asset. The current HSR project is a political deal and not a transportation project.

30. The structure of 1A is intended to prevent the expenditure of funds that could result in a segment that is not complete. The ICS managed to escape that fiscal discipline, but will not escape it in the future, should there be an attempt to use the bond funds.

31. So far, the HSR system is entirely a public works project. As stated on p. 35, it is government owned and constructed, based on government decisions.

32. In seeking to achieve zero GHG emissions construction, the full lifecycle emissions of the materials used in construction must be included. They were not included in the 2013 GHG analysis done for the Legislature.

35 & 36 & 38. Bringing in an operator after the route has already been selected is far too late, if the intent is to have significant private sector investment.

39. The train operator needed to be involved in the most important planning decision: the route. It is insulting to the public to claim that the train operator must be at the forefront of business model development, when the political process distorted the route selection so badly as to make the project infeasible.

40. The key decisions most important to the private sector have already been made. The likelihood of getting future investment is small, because the route can be expected to perform poorly. Adequate ridership is very unlikely.

45. The logical way to secure private sector participation would have been to offer rail operators the ability to propose their own routes, with the assumption of ridership risk. Instead, CHSRA proposes to place 100% of the risk of the first $21 billion on taxpayers. The Authority refused to consider route flexibility on an unsolicited proposal by SNCF America, which had the investment banking support to build the San Francisco-Los Angeles system. (See http://transdef.org/HSR/Private_Capital.html)

45. The assertion that HSR "will enable people to work at high-tech jobs in the Silicon Valley and San Francisco while having greater access to more affordable housing options in Central Valley..." is inconsistent with HSR as a profit-making business. Commuting is only viable with a subsidized public transit business model, because HSR is far more costly.

49. See above for a discussion of the packages of projects.

49. Greenhouse gases are not criteria pollutants that cause human health impacts. The cumulative global GHG emissions cause climate impacts, not direct health impacts. As a result, there is no relief provided to disadvantaged communities.

50. The Santa Fe Springs triple tracking may provide benefits to Amtrak and Metrolink, but isn't HSR supposed to have dedicated tracks here?

56. The cost estimate only covers access to 4th and King in San Francisco, which is not the terminus of the system. What is the total cost of Phase 1 to the Transbay Transit Center?

75. Does the inflation in O & M costs in Exhibit 7.16 portend future problems with ridership? The ridership model documentation is silent on whether this degree of inflation could eventually affect demand. It should not be assumed that price elasticity

remains constant. At some fare point, the elasticity has to hit a breaking point, resulting in a death spiral.

88. It would be appropriate to identify the program level risks of 1). the invalidation of cap and trade by the courts; 2) the invalidation of the HSR appropriation of cap and trade by the courts; and 3). the Legislature's inaction on extending cap and trade, and providing the necessary framework to enable securitization, which is the foundation of the Business Plan.

89. A major risk that remains unidentified is the absence of a regulatory structure for implementing 25 kv. overhead power on blended systems. There cannot be a Phase 1 without these rules, yet no proceeding is open at the CPUC.

89. The mitigations listed for declining shareholder support are unlikely to be effective. See transparency suggestion, above.

92. CHSRA petitioned STB for the preemption of CEQA. This should be listed as environmental risk mitigation. The uncertain future of preemption, on appeal both in federal court and in the California Supreme Court, is a risk that needs to be identified.

92. A major risk that remains unidentified in the Business Plan is the trackage right Union Pacific RR has on the Caltrain ROW. UP will have to give its permission for CHSRA to provide intercity rail service in the Corridor. Until an agreement is in place, CHSRA needs a fallback plan. We believe the fallback should be obvious, given TRANSDEF's past litigation.

Conclusion

In these comments and in the previous twelve years of advocacy, TRANSDEF has provided constructive suggestions for how to achieve a functioning and profitable HSR system in California. As we have continuously predicted, due to its non-viable business model, CHSRA is about to run out of money. TRANSDEF is always willing to meet with CHSRA staff and/or Board to assist in changing direction.

Sincerely,

/s/ DAVID SCHONBRUNN

David Schonbrunn,
President

Attachments

1. Analysis of the CHSRA's GHG Report. TRANSDEF. 2014.

2. High-speed rail with emerging automobiles and aircraft can reduce environmental impacts in California’s future. Chester, M. and Horvath, A. Environ. Res. Lett. 7 (2012) 034012.

Attachment 1

Transportation Solutions Defense and Education Fund

P.O. Box 151439 San Rafael, CA 94915 415-331-1982

Analysis of the CHSRA's GHG Report

On July 1, 2013, the California High-Speed Rail Authority released its *Contribution of the High-Speed Rail Program to Reducing California's Greenhouse Gas Emission Levels* (June 2013).[1] It is meant to fulfill the mandate contained in SB 1029 (the Legislature's authorization of HSR bonds for the Central Valley project) to provide "a report on the 'net impact of the high-speed rail program on the state's greenhouse gas emissions.'"[2] However, the report fails to quantify the project's emissions and emissions reductions, thereby making an evaluation of the program's net impact impossible.

The report is obviously intended to counter the Legislative Analyst's budget report[3] of April 2012, which concluded that the HSR project would result in a net increase in GHG emissions for the first 30 years of operations. Knocking down that report would open the door to funding HSR with cap and trade revenues. Interestingly, the CHSRA report never mentioned the LAO report and pretended it didn't exist. Someone must have concluded they couldn't win an argument on the merits.

Rather than dispute the LAO report, the CHSRA report claims to "detail[] the projected net greenhouse gas (GHG) emissions associated with the construction and operation of the high-speed rail system."[4] However, the report offers no details of those emissions. If numbers were developed during the preparation of the report, they weren't included in the publication. This is a politicized promotional piece and not a science-based document. It is simply not credible and not responsive to the legislative mandate.

Update: The Governor's Budget Proposal

The Governor proposed that $250 million in 2014-15 cap and trade revenues go to HSRA. He further requested that 33% of all cap and trade revenues starting with 2015-16 be continuously appropriated to HSRA.[5] These many billions of dollars, if not well-spent by the HSR project, could threaten the effectiveness of the entire cap and trade program. Careful scrutiny of the HSR project's net GHG benefits is warranted.

Methodology

A disclosure on p. 17 invalidates the entire report: "The timeframe and activities analyzed and discussed in this report were for CP1 [the first phase of the current Merced-Bakersfield project]. As the project moves forward, direct GHG emissions calculations will be carried out for each subsequent construction package." The construction impacts of CP1 cannot be meaningfully analyzed in relation to the operational emissions

reductions calculations, because the latter pertains to the Initial Operating Section (IOS), which is ten times its length. No HSR operations are planned for CP1.

This is critical, because the report is actually comparing the emissions benefits of the IOS to the emissions costs of the one-tenth-as-long CP1. Completing the IOS would require funding the $26 billion extension to the LA Basin, as well as building CP2, CP3, CP4 and CP5 [the remainder of the Merced-Bakersfield project]. Obviously, the net project emissions are going to be very different when the emissions arising from $26+ billion of construction are added in.

Evaluating the HSR program's net impacts requires either the operational emissions reductions of CP1 or the construction emissions of the IOS. This report offers neither.

Summary of Findings

The following six so-called Findings are mere restatements of vague intentions, with no identified funding to implement them:

- Commitment to 100% renewable energy during operations
- Zero net greenhouse gas emissions during construction
- Supportive transit and land use for greater cumulative benefits for the state
- Plans to plant thousands of new trees across the Central Valley
- Cleaner school buses and water pumps in Central Valley communities
- Agricultural conservation measures aimed at reducing Central Valley sprawl and preserving valuable agricultural land[6]

In addition, the report offers no evidence in support of the following two so-called Findings:

- Zero net greenhouse gas emissions during construction[7]

There is no evidence to support this claim. No numbers whatsoever are offered for GHG mitigation activities. This is a classic "aspirational goal" rather than a finding on a plan to achieve one.

- Significant contributions to the State’s goals embodied in AB 32 and SB 375[8]

There is no evidence to support this claim.

Not only is there no evidence to support the following three so-called Findings, they are actively misleading, as they are entirely dependent on CHSRA receiving an additional $26 billion to build out the IOS to the Los Angeles Basin. In addition, they will mislead non-technical readers because they appear to be findings on the project's net emissions impacts. Because they exclude the construction emissions of both CP1 and the IOS, they represent only one side of the emissions ledger.

- Greenhouse gas savings from the first year of operations increasing to over 1 million tons of CO2 per year within 10 years[9]
- Result in net GHG emissions diversions that, conservatively, are the equivalent of the GHG emissions created from the electricity used in 22,440 houses, or removing 31,000 passenger vehicles from the road.[10]

- Using methodologies consistent with state practice, an estimated 4 to 8 million metric tons of CO2 saved by 2030, as if the state turned off a coal fired power plant[11]

As discussed below, this last assertion is also misleading because the 8 years of operations are being compared to roughly one year of such a power plant's emissions.

GHG Emissions Sources for High-Speed Rail System

The diagram on page 9 is the only rendition of emissions category totals in the report. Amazingly, there is no corresponding table. The diagram comes closer to identifying the net impact than anything else in the report. However, its use of graphic symbols instead of conventional chart bars makes it impossible to interpret quantitatively. It is unclear from the diagram (or its associated text) whether the symbols have any quantitative significance, and if they do, whether emissions totals are represented by the height or by the area of the symbols. This makes the diagram both useless and deceptive: it obscures more than it discloses. Given the central importance of this data, choosing this indecipherable diagram for its portrayal can only be interpreted as an act of bad faith.

Operational Emissions Reductions

This project has had a long history of challenges to the technical validity of the HSR ridership model and litigation about the hidden changes that were made to it that advantaged Pacheco ridership while penalizing Altamont ridership. Ridership is the key input to an analysis of operational emissions reductions. As will be discussed later, the GHG reduction benefits of the HSR project are very dependent on ridership. With the controversy surrounding the ridership projections, this net emissions analysis rests on a shaky foundation.

The most striking part of this section is the meaningless apples-and-oranges comparison between the annual emissions of a coal-fired power plant and the emissions reductions from 8 years of HSR operations.[12] This is an attempt to invite positive identification with HSR by creating a "Coal Bad--HSR Good" dualism, a classic technique of promotion.

Construction Emissions

While the report uses standard methods to calculate the direct emissions resulting from construction, it entirely leaves out the emissions resulting from the acquisition of construction materials, and offers a weak justification that these emissions shouldn't be counted against the project:

> Regarding the construction materials, for some it is possible to calculate the impacts over the material's life-cycle, from extraction through processing, use onsite, and disposal, and express those impacts in GHG emissions terms. Those GHG emissions are usually the reporting responsibility of the manufacturer, and in terms of a project GHG emissions

> inventory, happen "upstream" and outside the boundary of the project.
>
> For example, cement manufacturers in California are subject to ARB's Mandatory Reporting and Cap-and-Trade Regulations. These regulations require cement manufacturers to report their GHG emissions annually to ARB. The emissions from cement manufacturing count towards the statewide GHG emissions "cap." The GHG emissions covered under the "cap" are required to be reduced through emission controls or a limited amount (eight percent) may be offset through the purchase of ARB certified offset credits.[13]

The problem is that these emissions from construction materials constitute a very significant part of the project's overall emissions, because of the huge amount of concrete called for in the plans. This amount is large enough to increase the cement manufacturing sector's statewide emissions, which makes the "count it upstream" approach entirely inappropriate when evaluating the project's net impacts.

Perhaps recognizing this, the next paragraph of the report acknowledges the appropriateness of including the emissions from construction materials in its analysis, yet withholds the data on the flimsy excuse that the data is not "precise" enough:

> However, the Authority considers it important to disclose the GHG emissions that occur outside of the project associated with materials used during construction. **These have not yet been quantified, due to the limitations of available information at this stage of project delivery.** While it is understood that the rail infrastructure will consist, largely of aggregate, concrete, steel, rails, and ballast; the **precise** source and supplier of those materials is not yet known. Additionally, the **precise** quantities are not available, given the nature of the design-build procurement process... (emphasis added)[14]

This is a masterful exercise in appearing to be fair-minded while simultaneously holding back damaging information. It is obvious that in the course of putting the project out to bid, the Authority prepared estimates of construction material quantities. These estimates were the basis for the calculation of the direct construction emissions. The materials' emissions must be **huge** for the Authority to need to bury them with this kind of double-talk.

The Legislative Analyst's April 2012 report[15] relied on a 2010 pioneering study by Chester and Horvath entitled *Life-cycle assessment of high-speed rail: the case of California.*[16] The study's 2012 update produced data that enabled this calculation: Infrastructure construction and operations contribute between 40% and 51% of the

CHSRA project's GHG emissions per person per kilometer travelled. This figure rises to near 100% of the emissions for the scenario with 100% renewable power, and falls to 32% when the train's capacity is nearly doubled.[17] The paper found "CAHSR infrastructure construction effects are dominated by concrete use. Approximately 67% of CAHSR infrastructure emissions are the result of cement production for concrete use..."[18]

This is the smoking gun: Construction materials (as well as infrastructure construction, if one doesn't assume the success of the zero net GHG emissions program[19]) make up a highly significant percentage of the project's overall GHG emissions. Leaving them out so compromises the net impact analysis as to render it worthless.

The Chester and Horvath study calculated the project's payback period, the point at which the emissions reductions from the substitution of auto and air trips (measured as Vehicle Kilometers Traveled, or VKT) with HSR trips equals the HSR project's GHG emissions, including its cumulative prior emissions:

> The payback sensitivity reveals several important considerations for transportation planners and air quality policy makers. The cumulative plum-colored lines for the high, medium and low forecast figures show that the **GHG payback will likely occur between 20 and 30 yr** (D3) **after groundbreaking**, and acidification potential after 20–40 yr. **However, payback is highly sensitive to reduced automobile travel.** The 5.8 billion auto VKT displaced dominate emissions changes in the corridor and the effects from reduced air travel and CAHSR are small. The reduced auto impacts are significantly affected or dominated by life-cycle components, in particular, avoided vehicle manufacturing, vehicle maintenance and gasoline production. (emphasis added.)[20]

Chester and Horvath are thus warning that any slip in ridership from currently predicted levels would delay the GHG benefits of HSR even further.

Double Counting

When evaluating statewide benefits, it is important that GHG emissions reductions calculations represent only the project's own properties. The model that was used, on the other hand, "also reflects the GHG emissions benefits of ARB's recent rulemakings including on-road diesel fleet rules, Pavley Clean Car Standards, and the Low Carbon Fuel standard."[21] This means that the report's emissions reduction calculations overstate the benefits accruing to the HSR project.

Offset Activities

The only way the CHSRA's GHG Report is able to claim a net beneficial GHG impact is by buying offsets in the form of environmental mitigations, including construction mitigations,[22] and farmland protection.[23] The strategy of the Cap and Trade program is

to purchase GHG-reducing offsets at the lowest cost per ton. There's something very odd about committing Cap and Trade funds to a project that increases GHGs, which then has to buy GHG-reducing offsets. It would be dramatically less expensive on a per-ton basis to fund the GHG-reducing projects directly. Buying these same offsets as part of a CHSRA project package is inherently far more expensive.

Conclusion

The report offers no numbers capable of serving as a basis for the conclusion that "the high-speed rail program will have a positive impact on reducing the state's greenhouse gas emissions."[24] Instead, that conclusion "'feels right' without regard to evidence, logic, intellectual examination, or facts"--the Wikipedia definition of Stephen Colbert's 'truthiness'.

Endorsements

The uncritical endorsements of the report by agency heads expose the depth of its politicization. It simply is not credible that sophisticated agency heads and their staffs failed to spot the profound flaws identified above. Brian Kelly, now Secretary of the State Transportation Agency, "reviewed and approve[s]" the report.[25] Mary Nichols, Chair of the Air Resources Board, "believe[s] the analysis is reasonable..."[26] Instead of the comprehensive overview expected of someone of her subject matter expertise, she offered only superficial comments on the emissions reductions from mobility choices, and avoided construction emissions and offsets entirely. These two endorsements make it obvious that the Governor ordered his people to "make HSR funding happen" no matter what.

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[1] hsr.ca.gov/docs/programs/green_practices/HSR_Reducing_CA_GHG_Emissions_2013.pdf

[2] p. 13. (Unless otherwise noted, all references are to the report accessible at the URL above.)

[3] Legislative Analyst's Office, *Funding Requests for High-Speed Rail*, April 17, 2012, p. 8

[4] p. 13.

[5] Legislative Analyst's Office, *Cap-and-Trade Auction Revenue Expenditure Plan,* February 2014, p. 5

[6] p. 6.

[7] *Id.*

[8] *Id.*

[9] *Id.*

[10] *Id.*

[11] *Id.*

[12] p. 11.

[13] p. 14.

[14] p. 14.

[15] Legislative Analyst's Office, p. 8

[16] Mikhail Chester and Arpad Horvath, *Life-cycle assessment of high-speed rail: the case of California*, Environmental Research Letters, January 2010.

[17] Mikhail Chester and Arpad Horvath, *High-speed rail with emerging automobiles and aircraft can reduce environmental impacts in California's future*, Environmental Research Letters, July 2012, p. 5 [Interpolated from the chart data in Figure 1]
[18] Chester and Horvath, 2012, p. 4.
[19] pp. 13-15.
[20] Chester and Horvath, 2012, p. 9.
[21] p. 19.
[22] p. 13.
[23] p. 15.
[24] p. 20.
[25] p. 1.
[26] p. 5.

Attachment 2

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High-speed rail with emerging automobiles and aircraft can reduce environmental impacts in California's future

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Abstract
Sustainable mobility policy for long-distance transportation services should consider emerging automobiles and aircraft as well as infrastructure and supply chain life-cycle effects in the assessment of new high-speed rail systems. Using the California corridor, future automobiles, high-speed rail and aircraft long-distance travel are evaluated, considering emerging fuel-efficient vehicles, new train designs and the possibility that the region will meet renewable electricity goals. An attributional per passenger-kilometer-traveled life-cycle inventory is first developed including vehicle, infrastructure and energy production components. A consequential life-cycle impact assessment is then established to evaluate existing infrastructure expansion against the construction of a new high-speed rail system. The results show that when using the life-cycle assessment framework, greenhouse gas footprints increase significantly and human health and environmental damage potentials may be dominated by indirect and supply chain components. The environmental payback is most sensitive to the number of automobile trips shifted to high-speed rail, and for greenhouse gases is likely to occur in 20–30 years. A high-speed rail system that is deployed with state-of-the-art trains, electricity that has met renewable goals, and in a configuration that endorses high ridership will provide significant environmental benefits over existing modes. Opportunities exist for reducing the long-distance transportation footprint by incentivizing large automobile trip shifts, meeting clean electricity goals and reducing material production effects.

Keywords: life-cycle assessment, high-speed rail, transportation, greenhouse gas
S Online supplementary data available from stacks.iop.org/ERL/7/034012/mmedia

1. Background

Deployment of new and more fuel-efficient transportation modes is expected in the coming decades. Next generation automobiles and aircraft are already entering the market. Despite major political and economic roadblocks in the United States, federal, state, and regional transportation and land-use planners are discussing high-speed rail (HSR) as a potentially better investment for future mobility. The discussion of new transportation options is often coupled with the identification of strategies to help reduce congestion and travel times. With increasing populations

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and long-distance transportation demand forecasts, HSR was made a centerpiece of the American Recovery and Reinvestment Act as a modal diversification strategy. While several corridors are under study, California in 2008 authorized $9.95 billion in bonds for their 1200 km system and the state legislature recently approved funding to start construction. Engineering and planning work are already underway, with possible groundbreaking in 2013 (CAHSRA 2012). While many technical, legal, economic, community and political battles loom, the California HSR (CAHSR) Authority has made significant progress towards deploying the system, which will connect Sacramento, San Francisco, Los Angeles and San Diego. In addition to direct mobility benefits, CAHSR has the potential to reduce long-distance transportation energy consumption and air emissions, provided measures are taken to encourage high ridership, minimize construction effects, and establish clean electricity contracts (Chester and Horvath 2010).

To understand the comprehensive energy and air emissions effects of deployment and adoption of CAHSR, a life-cycle assessment (LCA) framework should be used to assess future modes in the California corridor. The energy and environmental tradeoffs of CAHSR have been examined with then-planned vehicles and fuels (Chester and Horvath 2010) by constructing a life-cycle inventory using information from CAHSRA (2005), the then-current design data and with groundbreaking expected around 2010. However, many new corridor plans and design considerations have been made warranting new outlooks for the system. Forecasts for a future long-distance transportation system should include emerging and expected automobile, aircraft and HSR improvements. In this study, an environmental assessment of future long-distance travel is developed using the California corridor as a case study. We start by developing a per passenger-kilometer-traveled (PKT) attributional assessment of future transportation systems that expands the results of Chester and Horvath (2010) by evaluating (i) emerging automobiles and aircraft, (ii) new train designs, and (iii) low-carbon electricity scenarios. We then develop a consequential assessment for the corridor to determine the net effects of the decision to build a new HSR system. Following our past work, we identify the critical system design parameters that lead to transportation systems having larger or smaller human and environmental footprints than their competitors. Our goal is to identify the potential design, construction and operation pitfalls early so that transportation planners and operators can reduce future impacts at potentially lower cost.

The goal of this research is to develop a framework for assessing the environmental effects of long-distance transportation in the California corridor to provide more comprehensive measures of the greenhouse gas, human health and other environmental damage potentials of future systems. We anticipate that this framework will (i) aid policy and decision makers in the assessment of long-distance transportation options, (ii) provide HSR designers, engineers and operators with information on how to best reduce environmental damage potentials, and (iii) provide a standard methodology by which other US and international transportation systems can be evaluated.

2. Methodology

An environmental assessment is developed for automobiles, aircraft and HSR operating in the California corridor between 2030 and 2050. When performing an LCA a year of analysis is generally defined. We choose to evaluate modes in a two-decade range to acknowledge the uncertainty in adoption of HSR and the challenges of estimating future life-cycle process improvements in a single year.

LCA is the preeminent framework for evaluating the energy and environmental effects of complex systems and can be used to understand the tradeoffs of transportation decisions. Life-cycle inventorying (LCI) is one stage of LCA, the quantification of environmental flows. Impact assessment must be performed to connect physical flows to the human health, ecosystem quality, climate change and resource effects of ultimate interest (ISO 2006, Jolliet *et al* 2003). End-use energy and air emissions are first inventoried. Air emissions include greenhouse gases (GHG) and conventional air pollutants (SO_x, CO, NO_x, VOCs, PM_{10} and $PM_{2.5}$). GHGs are reported as CO_2 equivalence (CO_2eq) using radiative forcing multipliers of 25 for CH_4 and 298 for N_2O for a 100 yr horizon. The US Clean Air Act established a regulatory framework for criteria air pollutants to reduce direct human and environmental impacts. SO_2, CO, NO_x, PM and ozone are regulated through National Ambient Air Quality Standards. We evaluate NO_x and VOCs because they are ozone precursors.

The LCI results are joined with human and environmental impact characterization factors from the Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI, v2.03) in the development of a life-cycle impact assessment (LCIA) (Bare *et al* 2002). Impact characterization factors are used to show the maximum potential effects of pollutant releases. In addition to global warming (CO_2eq), human health respiratory, acidification, tropospheric ozone (smog) and eutrophication impact potentials are determined. We stress that impact potentials are the maximum effects that can occur and actual effects may be lower, or potentials may never turn into damages. However, given the challenge of combining air transport and chemistry modeling with concentration-response functions, endpoint damages have not been determined for this study. Bare *et al* (2002) provide background for TRACI and how air emissions are used to determine impact potentials.

2.1. Efficient and electric automobiles

Improved gasoline efficiency and plug-in hybrid electric vehicles (PHEV) are expected to have significant market penetration by 2030 (EPRI 2011). The 2007 US Energy Independence and Security Act established fleet-wide fuel economy standards at 35 mpg (15 km l^{-1}) by 2020. Furthermore, the US EPA and the National Highway Traffic Safety Administration have proposed a 102 g km^{-1} CO_2 standard for 2025, which is equivalent to a fuel economy of 54.5 mpg (23 km l^{-1}) (EPA 2011). Given these policies and trends, it is reasonable to expect future long-distance

automobile travel to occur in a vehicle that has improved fuel economy from the 21 mpg (9.6 km l^{-1}) average today (ORNL 2011). While a fuel economy standard does not translate to actual onroad performance, the range of economies modeled is intended to illustrate future potential performance of improved vehicles. Congestion effects are not modeled and it is acknowledged that this would increase the automobile footprint. Second-generation biofuels are likely to be a widespread transportation fuel in the future (Scown *et al* 2012), but we focus on reformulated-gasoline and electric vehicles.

Vehicle manufacturing, battery manufacturing (including replacement) and operation are evaluated with the GREET 1 (fuel-cycle) and 2.7 (vehicle-cycle) models (ANL 2011). A 35 mpg, 1500 kg sedan and a 55 mpg, 900 kg (before batteries) PHEV (ANL 2011) are modeled to meet future fuel economy standards. Large battery pack plug-in and battery electric vehicles are expected to have market penetration gains in the next decades, and we evaluate a PHEV60 (60 mi, 97 km all electric range) assuming that the first 97 km of a 480 km California long-distance trip are in charge-depleting mode and the vehicle is configured as a parallel hybrid drivetrain. GREET models vehicle emissions with a drive cycle that is 43% city and 57% highway. Using drive cycle characterizations from Karabasoglu and Michalek (2012), vehicle emissions are adjusted assuming that the beginning and ending 24 km of the trip occur in cities with the remainder occurring on highways. We believe that our PHEV60 assessment is conservative as future vehicles may have improved battery energy densities and intelligent operational controls that more effectively utilize a blended mode. The PHEV60 is modeled with one lithium-ion battery replacement and specifications are consistent with those modeled by Michalek *et al* (2011). All automobiles are evaluated with a 260 000 km lifetime. Brake wear, tire wear and evaporative losses are included. General maintenance and tire replacement are evaluated using EIO-LCA (GDI 2011). Lead-acid and lithium-ion battery replacement are evaluated with GREET. The energy and environmental effects associated with insurance industry operation (e.g., electricity consumption, waste management) are captured using EIO-LCA (GDI 2011).

The energy inputs and air emission outputs generated by the construction and maintenance of the California highway (interstate and major arterial) system serve as the infrastructure basis for future long-distance statewide travel. There are currently 12 100 km of California highways facilitating 250 billion annual vehicle-kilometers-traveled (VKT) (FHWA 2009). Across all California roadways there are 380 billion annual VKT and this is forecast to increase to 480 billion VKT by 2040 absent a HSR system (CAHSRA 2012). The 74% of asphalt surfaces are specified with a 15 yr life and concrete surfaces at 25 yr (both surface sub-bases are assumed to last 100 yr). Material production, transport, equipment process, and direct emissions from construction and maintenance activities are modeled with PaLATE (2004). Roadway construction effects are allocated to vehicles based on VKT splits and maintenance to heavy duty vehicles since damage follows a fourth-power relationship to axle load (Huang 2004). Roadway design specifications, herbicide use and overhead lighting are included (Chester 2008).

Gasoline vehicle and PHEV60 energy production are evaluated with GREET and are specified with parameters commensurate with Michalek *et al* (2011). California reformulated gasoline is used, and GREET estimates that 18% of crude oil feedstock will be extracted from oil sands by 2020. For the PHEV60 and CAHSR, future regional electricity is used (this is detailed in later sections). Gasoline and electricity production include raw fuel feedstock inputs, transportation, processing (or generation) and distribution.

2.2. High-speed rail

HSR effects are determined following the approach of Chester and Horvath (2010) but updated to acknowledge that a future CAHSR system will likely see improved train performance and an opportunity for increased renewable electricity usage. The assessment by Chester and Horvath (2010) was designed to evaluate the high-speed rail system specified by CAHSRA (2005) under a life-cycle lens. CAHSRA (2005) performs an energy assessment based on large 1200 seat trains consuming an exaggerated 170 kWh of electricity per VKT. Despite acknowledging this over-estimate, Chester and Horvath (2010) chose not to redesign the CAHSRA (2005) system or challenge the publicized parameters. Given the uncertainty in the CAHSRA (2005) propulsion electricity estimate, primary data collection exercises were undertaken to develop improved electricity consumption estimates for a future CAHSR train. In this study, we evaluate three train sizes (400, 670 and 1200 seats) and use actual electricity consumption outcomes from Deutsche Bahn, instead of relying on literature. A range of HSR propulsion electricity exists in the literature and a survey and comparison are performed in the supplementary information (SI, available at stacks.iop.org/ERL/7/034012/mmedia). Actual electricity consumption factors for ICE trains (preliminarily chosen by CAHSRA 2005) were gathered from Deutsche Bahn (2011) and correspond to those reported by IFEU (2011) resulting in 13, 20 and 36 kWh/VKT for the respective train sizes. Regenerative braking effects are included. It is possible that the trains deployed in California will be several generations newer and will consume less electricity, but without data on future technologies we choose not to make projections, and instead assume current state-of-the-art technology for CAHSR.

A study has been performed for the CAHSR Authority to evaluate the feasibility of deploying wind and solar electricity to meet system-wide electricity demands (Navigant 2008) and strategies have been developed to power the stations and trains with 100% renewable energy (NREL 2011). While funding for a renewable electricity infrastructure remains uncertain, this future configuration is considered using existing PV and solar study LCIs (Pehnt 2006) with an 80% wind and 20% solar mix.

Vehicle (manufacturing, maintenance and insurance), infrastructure (construction, operation, maintenance and

parking), and non-renewable electricity generation scenarios follow the methodology used in Chester and Horvath (2010, 2011) and are adjusted for future electricity inputs. The infrastructure assessment matches the results of Chang and Kendall (2011) when a commensurate system boundary is used. Whenever possible, we apply the Western Electricity Coordinating Council (WECC) electricity mix generation emission factors to scenario life-cycle components. Without a contract to purchase electricity from a particular supplier, electricity consumption by CAHSR should be evaluated in the WECC reliability network (Marriott and Matthews 2005), capturing flows across nearby states, including imports to California. Vehicle and infrastructure effects from WECC electricity use are based on a mix that has reached 2020 Renewable Portfolio Standards (WECC-RPS) (WECC 2011). Furthermore, a projected 2040 mix that has reduced coal inputs resulting in 60% carbon emissions intensity of today is also included (WECC-2040).

2.3. Next generation aircraft

Midsize aircraft (130–160 seats) were responsible for 79% of domestic US air travel PKT in 2009 (BTS 2011) and current and future planes are evaluated to capture significant improvements in engine fuel use and emissions. A Boeing 737–800 is used to evaluate currently operating state-of-the-art aircraft. The 737–800 seats 160 and uses CFM56-7B26/2 engines. The Bombardier CS300-ER is an emerging aircraft that offers 20% fuel savings (and commensurate GHG savings) and additional emissions reductions over in-service planes. The CS300-ER will use Pratt and Whitney (PW) 1524G PurePower engines offering propulsive efficiency gains while carrying up to 130 passengers. For both aircraft, maintenance and insurance costs are based on 737–800 airframe materials, engine materials, insurance and hourly costs of employee benefits, reported by BTS (2011). To provide perspective on energy and environmental gains in air travel, the 737–800 and CS300-ER are compared against the legacy Boeing 737 series (<800) which has been a workhorse of the mid-haul market (Chester and Horvath 2010).

Fuel and emission indices are used to determine landing–takeoff (LTO) and cruise phase effects for a San Francisco to Los Angeles flight. In previous studies, LTO effects were determined with FAA (2010) and cruise phase with EEA (2006) data. These software and data do not offer the flexibility or transparency to evaluate future engine improvements. FAA (2010) reports fuel and emission indices which are combined with time-in-mode and rated thrust estimates to determine total flight effects for the 737s. The CFM56-7526/2 engines on the 737–800 achieve 25% reductions in CO, 27% in HC, 31% in NO_x, and 97% in smoke emissions relative to CAEP6 engine emission standards (ICAO 2010). ICAO (2010) does not yet report PW1524G engine testing results, however, Hoke (2011) reports 64% reductions in CO, 96% in HC, 58% in NO_x, and 50% in smoke emissions relative to CAEP6 standards, which were used to determine the CS300-ER flight emissions. Flight LTO and cruise fuel consumption and emissions were validated by PW engineers (Pratt and Whitney 2011). Aircraft energy and environmental effects are determined with fuel and emission indices and rated thrust estimates by flight phase (see the SI for details, available at stacks.iop.org/ERL/7/034012/mmedia). The potential for respiratory, acidification and eutrophication impacts from non-LTO emissions are included (Barrett *et al* 2010, Tarrasón *et al* 2002).

3. Modal attributional footprinting

The assessment and allocation of direct and ancillary processes to each transportation mode reveal the life-cycle activities that should be targeted for the greatest environmental improvements. Consistent with existing transportation LCA studies, results are normalized to a per-PKT functional unit to evaluate the effectiveness of providing passenger mobility. For automobiles and CAHSR, a dearth of data exists to provide a rigorous assessment of expected occupancy rates. For aircraft, detailed reporting provides strong indicators for future utilization (BTS 2011). To avoid universally characterizing modal performance by normalizing to an average occupancy, reasonable and expected high and low occupancies are assessed to capture the *potential* of modes. For all modes, the high occupancy is the number of seats. Low occupancies are designed to consider off-peak ridership. While it is possible for CAHSR and aircraft to operate with a single passenger, this outlying case is not informative and therefore not shown. Low occupancy for CAHSR is approximately one-quarter of seats, and for aircraft is the lower occupancy quartile in 2009, determined from BTS (2011). Figure 1 shows global warming and human health respiratory life-cycle results for each mode for high and low occupancy.

GHG emissions are dominated by vehicle propulsion (energy production for CAHSR and vehicle operation for automobiles and aircraft) but show increases of 38–54% for automobiles, 77–116% for future CAHSR and 13–34% for aircraft when all life-cycle components are included. Results for future long-distance modes are consistent with those identified in past transportation LCA studies (Chester and Horvath 2010, 2009) even when new data and modeling are included (ANL 2011). Automobile vehicle manufacturing is dominated by steel and plastic use (ANL 2011), and maintenance effects are largely the result of supply chain electricity (GDI 2011). CAHSR infrastructure construction effects are dominated by concrete use. Approximately 67% of CAHSR infrastructure emissions are the result of cement production for concrete use and 9% are related to steel production. Automobile infrastructure effects are small compared to past studies because only highways are included to isolate long-distance infrastructure. The inclusion of trip-specific infrastructure provides a clearer comparison of corridor travel by focusing only on roads, tracks and airports needed for each trip. Non-propulsion fuel-cycle effects are primarily the result of refineries, oil and gas extraction activities, and supply chain electricity use (ANL 2011, GDI 2011). With distributed hard infrastructure and its long-distance nature, the life-cycle effects of air

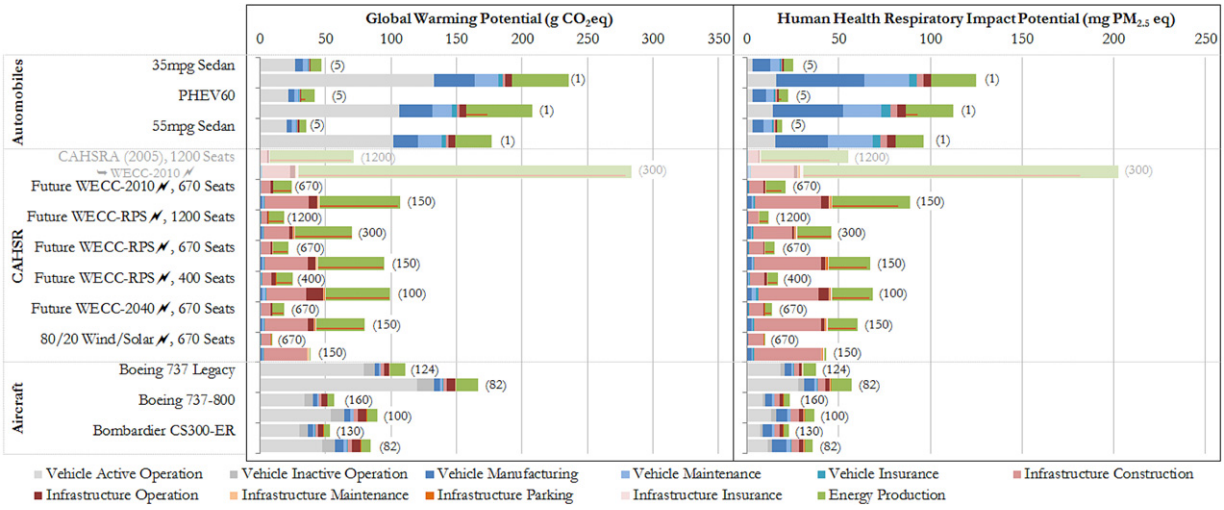

Figure 1. Global warming and human health respiratory impact potential results per PKT. For each mode, results at long-run average high and low occupancy (shown in parenthesis) are displayed as juxtaposing bars. Previous research by the authors reported electricity generation effects for electric vehicle propulsion in the *Vehicle Operation* life-cycle groupings. In an effort to improve the spatial characterization of effects, electricity generation for CAHSR propulsion is reported in *Energy Production* and differentiated from upstream effects (e.g., emissions from fuel extraction and transport) by a red line. The CAHSRA (2005) train is shaded gray to emphasize that it is an unlikely outcome, but reported for comparative purposes.

travel are diminished when results are normalized per PKT. WECC-2040 electricity reduces HSR GHG propulsion emissions by 26% but infrastructure construction effects continue to add heavy burdens to life-cycle results showing the need for low-CO_2 materials.

Across modes and life-cycle groupings, PM_{10} emissions are often generated by mining activities for raw materials, and $PM_{2.5}$ emissions by supply chain combustion processes including electricity generation, the latter contributing to human health respiratory impact potentials. While PHEV60s produce fewer $PM_{2.5}$ emissions during propulsion, battery manufacturing and associated electricity requirements have the potential to contribute significant $PM_{2.5}$ and SO_x emissions and increase respiratory impacts beyond the 35 mpg sedan. This implies that strategies should be developed that minimize human and environmental exposure as the battery industry expands, and that meeting or exceeding RPS standards will reduce impacts across automobiles and CAHSR. For CAHSR, concrete and steel production including upstream mining activities are larger than propulsion effects. The dominating share of environmental impact potentials are often in non-propulsion components and are shown in figure 2.

Several common processes dominate the environmental impact potentials. Vehicle manufacturing and maintenance are affected by assembly activities, but are dominated by the use of metals (i.e., steel, aluminum and copper) and its associated electricity demands for processing. Supply chain truck transport for these processes also contributes heavily to CO, NO_x and VOC emissions. Asphalt and concrete use dominate infrastructure construction and the use of these materials is affected primarily by direct emissions at hot-mix asphalt and cement kilns, and their associated electricity demands. Airport ground support equipment use contributes heavily to aircraft life-cycle results. For automobiles and aircraft, fuel production effects are largely the result of refinery electricity demands and extraction activities, and for HSR are dominated by primary fuel extraction, processing and transport. Air pollutant emission reductions may achieve the largest benefit-to-cost ratio by targeting infrastructure and supply chain effects.

Assuming that options exist, the decision by a traveler to take a mode produces marginal effects in the short-run, a subset of those reported in figures 1 and 2. For example, the decision to walk instead of driving immediately avoids fuel consumption and emissions from vehicle operation. Including mid-run life-cycle components avoids vehicle manufacturing, vehicle maintenance, vehicle insurance, infrastructure maintenance, and associated supply chain effects including fuel refining. Ultimately, a critical mass of travelers choosing to walk instead of drive would have long-run effects including reductions in roadway capacity needs avoiding future infrastructure construction. Marginal effects are critical for understanding the change in energy or environmental outcomes from a policy or decision. Long-run average effects are reported to provide a comprehensive set of indicators for analysts, however, future analyses with these results should consider marginal effects at specified timescales. Long-, mid- and short-run average and marginal comparisons are presented in the SI (available at stacks.iop.org/ERL/7/034012/mmedia).

Considering the potential of a mode to environmentally outperform another is critical to developing strategies that acknowledge different long-term operating characteristics. Modal potential considers the occupancy range in which transportation systems operate instead of averages which can mask peak and off-peak, position along lines and day-of-week characteristics, to name a few. Future CAHSR ridership forecasts have been developed and scrutinized (Brownstone *et al* 2010). Designs that do not access airports

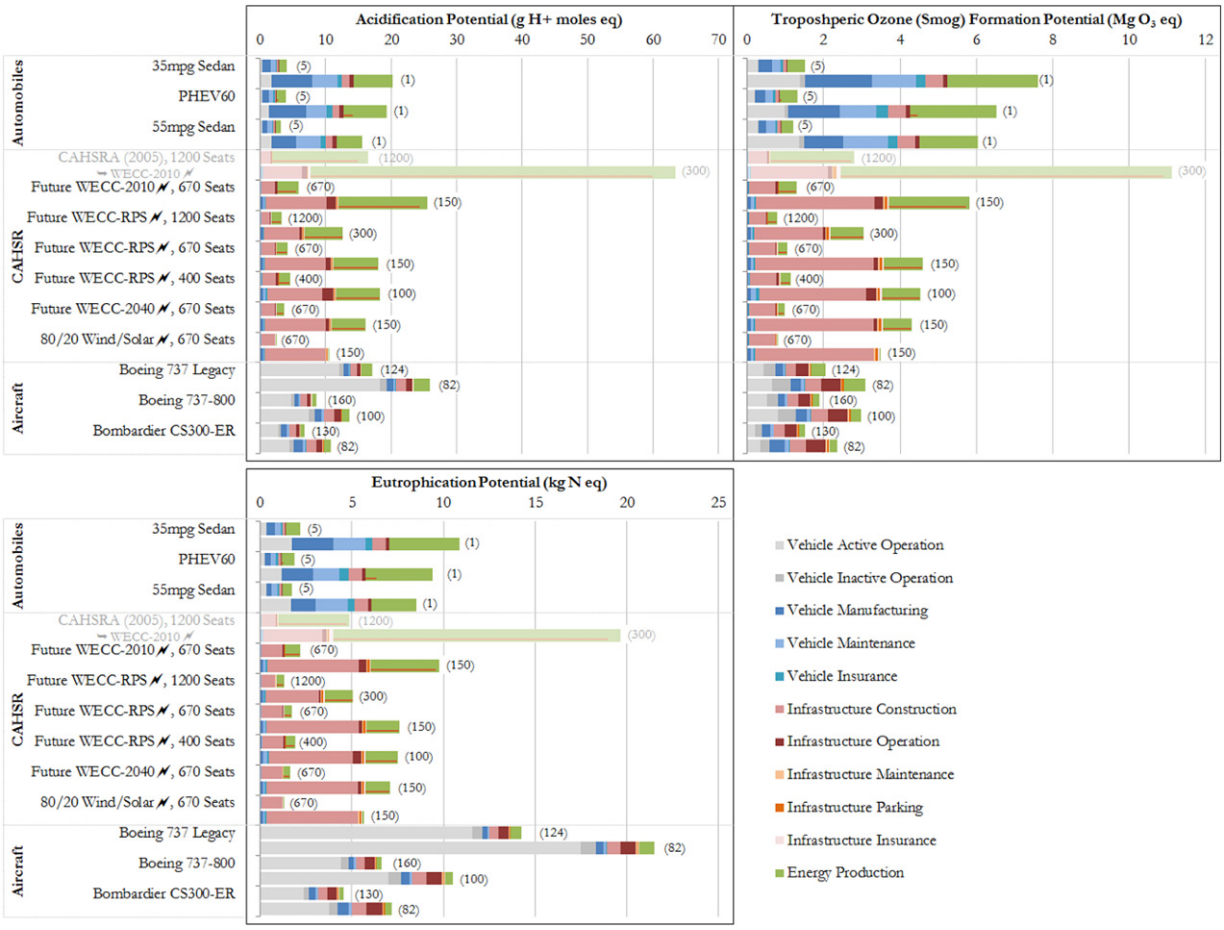

Figure 2. Environmental impact potentials per PKT.

and city centers, hub existing transit at HSR stations and encourage urban infill are inimical to high ridership, and risk disincentivizing trip takers switching from autos. Technical, political, community and economic roadblocks exist for many high ridership configuration options that could ultimately lead to lower than optimal adoption outcomes. Furthermore, even with high ridership configurations, the system will at times (whether during off-peak or end-of-lines) exhibit fluctuations and these instances should be considered in policies that target marginal operation. Given the large uncertainty in a future HSR system's ridership, figure 3 shows the CAHSR life-cycle and vehicle propulsion effects at varying occupancy levels against a current mean occupancy automobile and midsize aircraft (represented as a 2.2 passenger 35 mpg sedan and 116 passenger 737–800).

The sensitivity to vehicle occupancy is used to illustrate breakeven points, or the ridership levels where one mode is equivalent to another in the long-run. Occupancy levels of between 80 and 280 passengers produce HSR GHG-equivalency to future automobiles or aircraft (depending on train size). However, for acidification potential, this equivalency increases to between 160 and 420 passengers, or roughly 35–40% average occupancy for trains. This assumes that the WECC has met the RPS. The acidification breakeven points capture the dynamic of mode switching from low-sulfur liquid fuels to high-sulfur electricity and reaffirm the findings of Chester and Horvath (2010) that deployment of HSR should occur with mandates for cleaner propulsion electricity sources to avoid increased human and environmental impact potentials. The breakeven point assessment highlights the importance of future ridership scenario considerations in the determination of potential corridor effects.

4. Regional consequential effects

To evaluate the net effects of the decision to implement a new system in the corridor, a consequential assessment is developed. A consequential assessment should compare a *without HSR* future where additional automobile and aircraft capacities are needed to meet growing demands to a *with HSR* future where the new rail system reduces the need to fully build this capacity. Estimates of this capacity expansion have been produced by the Authority (PB 2011) and the LCA methods can be used to evaluate the change in effects in the corridor. The per-PKT results reported in figures 1 and 2 are valuable for understanding the footprint of each transportation system in the long-run but do not allow for direct assessment of the changes in corridor impacts when a new system is implemented. For example, an infrastructure will be constructed to facilitate an

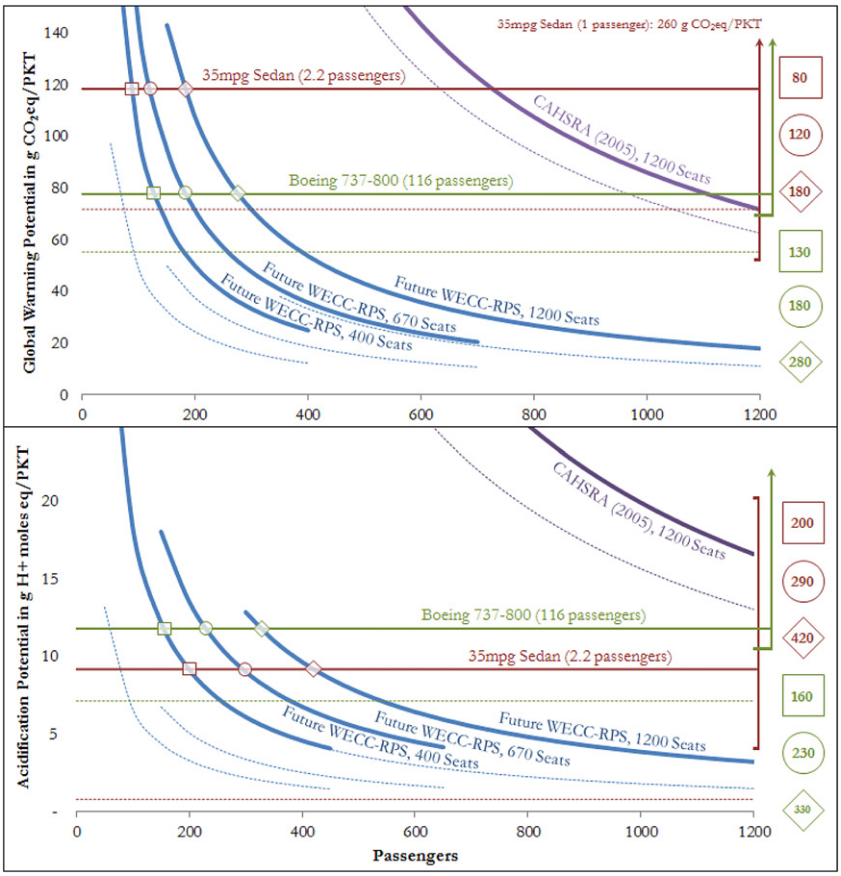

Figure 3. CAHSR global warming and acidification potential sensitivity to vehicle occupancy. Life-cycle results are shown as solid colored lines and vehicle propulsion as dotted. Breakeven points are shown as red and green shapes on the figure and corresponding ridership levels are shown on the right side. While average occupancies are shown for the 35 mpg sedan and 737–800, their potential ranges are shown as vertical lines on the right side.

expected level of service for CAHSR. This infrastructure may be flexible to accommodate more passengers if demand is greater than anticipated. Yet if the per-PKT GHG results in figure 1 are applied to the different PKT demand forecasts, different net infrastructure construction effects would be falsely determined (i.e., the infrastructure construction effects remain the same with different ridership outcomes). While the attributional assessment can inform questions like: *what are the major energy and environmental processes in the life-cycle of a transportation system, and how can they most effectively be reduced?* A consequential assessment is needed to answer questions such as: *how can California deploy a future multi-modal transportation system with the lowest human and environment impacts?*

The energy and environmental costs of a new HSR system should be compared against the avoided costs of automobile and air infrastructure expansion, assuming there is long-distance travel demand growth. PB (2011) estimated that 3600 freeway lane km and 13 000 m of runways, and 115 additional airport gates are needed to meet growing corridor demand in the coming decades. This is the only assessment of future infrastructure expansion needs to date and it is possible that this is an aggressive estimate. PB (2011) estimates are based on full corridor future capacity (117 million auto and air trips) and the most recent forecasts estimate 33 million HSR trips at high ridership. Therefore, 28% of infrastructure expansion effects are considered (i.e., 1000 lane km, 3600 m of runways and 32 additional airport gates) to account for only the avoided effects of HSR travelers and may be an aggressive allocation because of induced demand. Using roadway design guidelines (AASHTO 2001), construction and maintenance energy and emissions were calculated with PaLATE (2004) following Chester and Horvath (2009). The runway expansion would come with an estimated 670 000 m^2 of taxiways and tarmacs. Construction and maintenance of concrete runways and asphalt taxiways and tarmacs are also evaluated with PaLATE (2004) using dimensions reported by Chester (2008). For all surfaces, it is assumed that the wearing courses will last 20 yr and subbases 50 yr. It is also assumed that infrastructure expansion will start 10 yr after it has been decided not to build HSR, and will occur over 30 yr. Airport gate and corresponding concourse expansion construction follow the methodology of Chester (2008). Detailed construction and maintenance schedules for the infrastructure expansion are provided in the SI (available at stacks.iop.org/ERL/7/034012/mmedia).

Consequential effects are highly sensitive to modal shifts and forecasting of HSR energy and environmental effects should occur with uncertainty assessment. Forecasts for CAHSR adoption have only been reported by the Authority making rigorous uncertainty assessment challenging. Adoption discussions by the Authority have been presented through

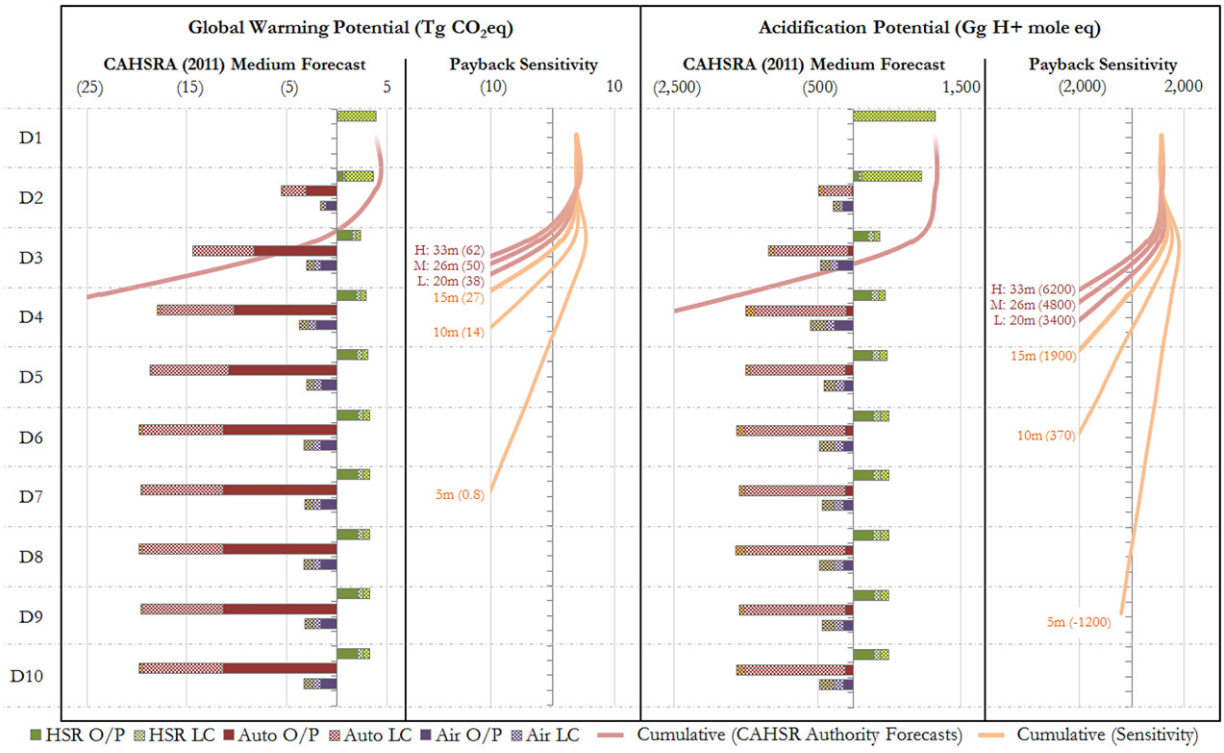

Figure 4. Decadal (D) consequential global warming and acidification potentials including payback for phase 1. O/P = operation and propulsion components (impacts from energy consumed to move vehicles). LC = life-cycle (excludes operation and propulsion components). Life-cycle effects are separated by infrastructure expansion (yellow background) and non-infrastructure (e.g., vehicle manufacturing and maintenance). After each ridership forecast (shown in millions (m) of annual trips in 2040), the 50 yr savings are shown in parentheses. These savings are the GHG or acidification benefit (negatives are costs) after 50 yr from groundbreaking.

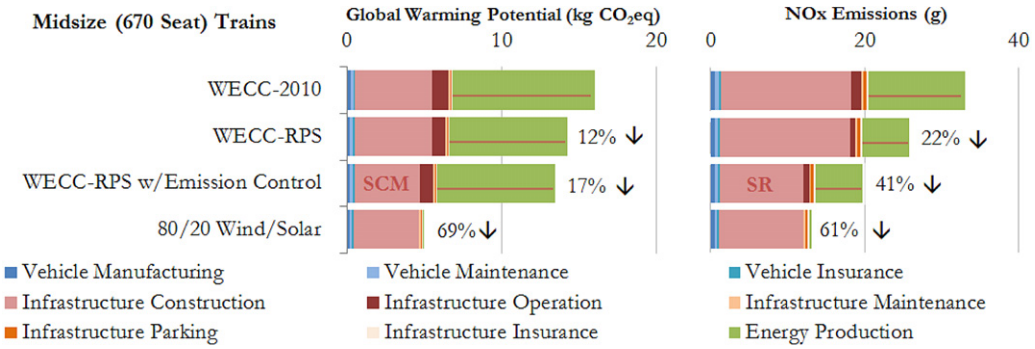

Figure 5. Energy and emission control strategies for reducing environmental impacts per VKT.

without HSR and *with HSR* forecasts. The consequential assessment considers the difference between these two, essentially, what environmental changes have occurred in California as a result of implementing HSR. The current forecasts report that by 2040 CAHSR Phase 1 (San Francisco to Los Angeles) will perform between 27 and 41 million annual VKT (PB 2012a). The Authority's medium *with HSR* forecast (34 million HSR VKT) displaces 5.8 billion auto VKT and 5.1 million air trips annually, generating between 20 and 33 million trips on the new mode (PB 2012a, 2012b). Using these forecasts, the Authority's medium (middle) projection is first evaluated to determine the consequential effects at full adoption in 2040. The WECC-RPS 670 seat HSR train is compared against displaced travel in a 35 mpg sedan and 737–800 aircraft (assumed to be reasonable representative vehicles for 2040). In the *without HSR* scenario, it is estimated that auto travel will increase from 380 billion VKT today to 480 billion VKT, and air travel will increase to 33 million trips (PB 2012b).

The deployment of CAHSR will create induced demand as a subset of trip takers who would not travel by auto or air now find the generalized cost for the journey lower than existing options (Outwater *et al* 2010). Additionally, access to and from HSR stations by autos and other modes may induce new system-wide demand. The CAHSRA (2012) *with HSR* forecast includes estimates of new trips and these are bundled in the aforementioned VKT. We model induced demand implicitly through the change in travel reported by CAHSRA (2012). A summary of the *with HSR* and *without*

HSR consequential analysis critical parameters is provided in the SI (available at stacks.iop.org/ERL/7/034012/mmedia).

The consequential assessment evaluates the difference between a future where CAHSR has or has not been constructed. Figure 4 shows the GHG and acidification potential for operation/propulsion and other life-cycle (including the avoided expansion of auto and air infrastructure) effects aggregated per decade for Phase 1 of the system (San Francisco to Los Angeles). The cumulative effect curve shows the time until payback. Given the uncertainty in the forecasts (Brownstone *et al* 2010), a payback sensitivity analysis is performed on the high adoption scenario as reported by the Authority (41 million VKT). The sensitivity analysis evaluates how long it takes CAHSR to achieve payback given certain adoption levels (for perspective, the Authority's low adoption scenario is 66% of ridership in the high adoption scenario) and considers the high (H), medium (M) and low (L) scenarios followed by decreases of 5 million (m) annual riders.

The payback sensitivity reveals several important considerations for transportation planners and air quality policy makers. The cumulative plum-colored lines for the high, medium and low forecast figures show that the GHG payback will likely occur between 20 and 30 yr (D3) after groundbreaking and acidification potential after 20–40 yr. However, payback is highly sensitive to reduced automobile travel. The 5.8 billion auto VKT displaced dominate emissions changes in the corridor and the effects from reduced air travel and CAHSR are small. The reduced auto impacts are significantly affected or dominated by life-cycle components, in particular, avoided vehicle manufacturing, vehicle maintenance and gasoline production. For GHGs the sooner the system is implemented the more opportunity it will have to help meet GHG reduction policies aiming for 80% of 1990 statewide emissions by 2050. Larger trains or more carbon-intensive electricity generation will delay the payback further. Acidification, the release of SO_x and NO_x emissions which are of concern for respiratory and cardiovascular (through secondary particle formation) effects, agricultural impacts and increased built environment maintenance costs, are dominated by life-cycle processes. For infrastructure life-cycle processes acidification is dominated by the combustion of sulfur-bearing compounds in clinker manufacturing for cement used in concrete freeways, and for non-infrastructure life-cycle processes supply chain electricity use. Ultimately, impacts should account for the time-based radiative forcing of GHGs, high-altitude CO_2 emissions effects, and the shifting of human and environmental effects from vehicle tailpipes to powerplants, to name a few additional factors. We reserve these analyses for future studies. The results of the consequential assessment are highly sensitive to automobile trips avoided and efforts should be made to validate the travel demand model used by the Authority.

5. Strategies for reducing environmental impacts

Given the dominating HSR life-cycle effects from electricity generation and infrastructure construction, strategies can be identified to reduce the system's footprint, prior to its construction and use. First, by meeting the RPS, GHG and NO_x emissions will be reduced by 12% and 22%. Next, emission control strategies are identified for reducing the infrastructure footprint. For GHGs, the use of supplementary cementitious materials (SCMs) such as fly ash or ground granulated blast furnace slag can reduce concrete's footprint by 14–22% depending on the mixture (Flower and Sanjayan 2007). It is expected that the portion of the infrastructure that impacts roadways will be required to use fly ash to meet California Department of Transportation requirements. Furthermore, if the Authority requires concrete producers to utilize cement kilns with selective catalytic and non-catalytic reduction (SR) advanced NO_x controls, material production emissions can be decreased between 35 and 95%, reducing the potential for acidification, respiratory, smog and eutrophication potential impacts (EPA 2007). Lastly, the use of 100% renewables lowers electricity generation impacts (to only power generation facility construction effects) and combined with the infrastructure control strategies produces the greatest reductions. The effects of these strategies are shown in figure 5.

The impact reduction strategies can decrease GHGs between 12 and 69% and NO_x emissions between 22 and 61%. The costs of implementing these strategies should be compared against other opportunities, particularly those identified by GHG and air quality policies. The 80/20 Wind/Solar train, outside of the infrastructure material footprint, has a payback within the first few years of operation and is equivalent to the GHG assessment developed by the Authority, based on NREL (2011), following California Environmental Quality Act requirements.

The transportation emissions reduction from CAHSR, if operating within a cap-and-trade system, should be evaluated. Cap-and-trade programs have been successfully implemented in the US for NO_x and SO_x, and California continues to discuss a GHG initiative. Cap-and-trade programs remove the potential of any single initiative to reduce aggregate emissions as offsets will be met by increases elsewhere in the economy (Millard-Ball 2009). This is because the cap is designed to equalize the marginal abatement cost and does not encourage each economic sector to undertake reductions. Furthermore, if road and rail emissions are part of the cap but aircraft emissions are not, then the only major GHG change resulting from HSR implementation will be the displaced airplane operational emissions. To meet GHG reduction goals, policy makers should consider where CAHSR potential reductions will be counted, whether that is in a cap-and-trade program or direct transportation mandates.

6. Planning for a sustainable mobility future

HSR has the *potential* to reduce passenger transportation impacts to people and the environment, but must be deployed with process and material environmental reduction measures and in a configuration that will ensure high adoption. We have highlighted the life-cycle hotspots that dominate modal success: (i) train size (affecting electricity consumption,

frequency of service and ridership); (ii) infrastructure construction; and (iii) the fossil fuel intensity of the electricity mix. By identifying low and high adoption outcomes, the potential benefits can be discussed, instead of speculating on a normative long-distance transportation future, especially in light of large uncertainty that surrounds many critical factors of the system. Ultimately, this research aims to inform planners and decision makers about providing sustainable mobility options. Planners and policy makers should be asking how a future sustainable transportation infrastructure can be deployed to meet increasing travel demands with the lowest total cost, including externalities. The environmental benefits of HSR should be joined with other considerations when making decisions about the system. Ultimately, decision assessment should include changes in travel time, productivity, congestion, safety, transportation infrastructure resilience, freight synergies, urban development opportunities and employment, in addition to GHG, human health and environmental damages.

Acknowledgments

The authors would like to thank several organizations and individuals for their intellectual support of this research. Elizabeth Mitchell and Domingo Sepulveda of Pratt and Whitney, and Professor Alan Epstein of MIT and Pratt and Whitney were instrumental in helping us determine future aircraft fuel consumption and emissions. Constantin Vogt of Deutsche Bahn provided valuable information and data on the operations of an established HSR system. Jeremy Michalek, Orkun Karabasoglu (Carnegie Mellon University) and Constantine Samaras (RAND) provided invaluable guidance for the PHEV assessment. Finally, the authors would like to express profound gratitude to Lee Schipper, who passed away during the development of this study, and provided continuous support and encouragement.

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Letter 4

Transportation Solutions Defense and Education Fund

P.O. Box 151439 San Rafael, CA 94915 415-331-1982

March 22, 2017
Uploaded to:
sb375targetupdate-ws

Mary Nichols, Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Regional GHG Emissions Reduction Targets Updates

Dear Ms. Nichols:

The Transportation Solutions Defense and Education Fund (TRANSDEF) is an environmental non-profit dedicated to the regional planning of transportation, land use and air quality. Our specific focus is on reducing the climate impacts of transportation. Our previous comments on the Scoping Plan and Regional GHG Emissions Reduction Targets ("Regional Targets") are posted on our website and are incorporated herein by reference: http://transdef.org/Climate_Change/Climate_Change.html

Compliance with SB 375

TRANSDEF contends that ARB has not complied with the requirements of SB 375 in its prior approval of Regional Targets and its decision to not update them. By essentially accepting the recommendations of MPOs for their respective targets, ARB allowed each of the regions to have per capita targets that were lower than the expected rate of population growth. By simple arithmetic, as the population grows, that must inevitably result in higher regional GHG emissions than current levels, even if MPOs achieve their targets. That outcome is completely opposite to the Legislature's intent in adopting SB 375. The legislative findings for SB 375 identify that:

> ...greenhouse gas emissions from automobiles and light trucks can be substantially reduced by new vehicle technology and by the increased use of low carbon fuel. However, even taking these measures into account, it will be necessary to achieve **significant additional** greenhouse gas reductions from changed land use patterns and improved transportation. Without improved land use and transportation policy, California will not be able to achieve the goals of AB 32. (Chapter 728, Statutes of 2008, Section 1(c) and (i), emphasis added.)

TRANSDEF asserts that the following elements will be necessary to approve a legally defensible Regional Targets update:

- BAU emissions estimate for the light-duty vehicle sector covered by SB 375
- Scoping Plan emissions reduction targets for each emissions sector, including for this sector, that in total achieve the state's targets
- Emissions projections for this sector for each region, based on the proposed targets
- Certification by staff that, if the proposed targets were achieved by each region, the overall emissions for this sector would be significantly reduced.

These elements constitute an inherently top-down process. The 2016 Mobile Source Strategy states that "ARB and the MPOs will be working on a comprehensive bottom-up process to update SB 375 targets." (p. 51.) We assert that ARB has misinterpreted the law as a call for a bottom's-up process. All the law prescribes is that “Prior to setting the targets for a region, the state board shall exchange technical information with the metropolitan planning organization and the affected air district. The metropolitan planning organization may recommend a target for the region.“ G.C. 65080(b)(2)(A)(ii).

ARB needs to reconsider its 2010 decision to use a bottoms-up approach, as it is not working. No transportation agency we are aware of has yet acknowledged that climate change is its problem. They all act as if some other agency--most likely ARB--is going to take care of the problem, and leave them out of it. They continue to facilitate solo driving and see no need to change, as they are truly oblivious of the consequences in GHGs.

The 2014 SB 375 Implementation review avoided the question of the cumulative statewide emissions reductions resulting from the regional targets. Buried in an obscure ARB publication was the calculation that the SB 375 program will produce reductions of 3 $MMTCO_2e$, where the 2008 Scoping Plan had a placeholder target of 5 $MMTCO_2e$. This gap has never been dealt with.

The Proposed Final 2017 Scoping Plan Update states:

> Stronger SB 375 GHG reduction targets will enable the State to make significant progress toward this goal, but alone will not provide all of the VMT growth reductions that will be needed. There is a gap between what SB 375 can provide and what is needed to meet the State’s 2030 and 2050 goals. (p. 101.)

TRANSDEF asserts that the gap referred to in this quote is the gap between the Regional Targets that are proposed by MPOs and those that are derived from a top-down process intended to achieve statewide targets. We further assert that if there is a gap remaining after the adoption of updated Regional Targets, ARB will have shirked its duty to best implement the intent of AB 32 and SB 375.

Pricing

We note that the adopted Regional Targets acquiesced to the notion that because land use effects are long-term, it is logical that the 2020 targets be lower than the 2035 targets. This approach completely ignores the realm of pricing measures, which can be implemented very quickly. We associate the absence of a discussion of the feasibility of pricing with the contentious national attitude towards a pressing emergency.

Scientists inform us that there are only a few years left to correct our emissions overhang before irreversible and catastrophic changes take place. We call on ARB to use the best science to recognize the urgent need for early reductions. This will require strong leadership to educate the public about the need for increased pricing of driving. We fully recognize this will take political courage and offer to assist in any way we can.

Timing

We reject the idea that lower, more achievable, targets are a wise idea. We don't have 10 or 20 years to build confidence. Unfortunately, climate is not a problem that can be responded to at a pace that is comfortable for government. We previously commented that The *Preliminary Draft Staff Report on the SB 375 Greenhouse Gas Reduction Target Update Process* (2014) lacked any sense of urgency. It seems to us that the first step in updating Regional Targets is for the Board to decide "Are we facing a climate crisis?" The degree of crisis perceived will determine the outcome of the process.

Margin of Safety

As climate science advances, it becomes ever more clear that larger reductions are needed, and needed sooner than previously thought, as the models had been overly conservative. We recommend that target setting include the provision of a margin of safety, as is commonplace in the setting of health-based criteria pollutant standards.

Conclusion

Right now, science is telling us what needs to be done and government is not doing it. The target-setting process is not just a technical exercise. ARB's work needs to become a national and global model for the responsible planning of development. If human civilization is to survive climate change, it is crucial that targets be adopted that lead to sufficient change. Failure to do so is not an option.

The challenge for Board members now is the question "Are we facing a climate crisis?" When each member is able to answer it in a way that they can feel comfortable defending to future generations, ARB will be ready to make wise policy decisions.

It will take a top-down process tied to the Scoping Plan's goals to provide sufficient justification for making uncomfortable policy decisions at the State, regional and local levels. Local elected officials expecially need this kind of evidentiary backup--they will be on the front lines, making scary decisions for a public that does not like change. Please give them the leadership and the guidance they need to play their part in the upcoming difficult transition to a low-carbon way of life.

We would be pleased to answer any questions you might have, at the phone number above.

Sincerely,

/s/ DAVID SCHONBRUNN

David Schonbrunn,
President
David@Schonbrunn.org