

# How to end the gas tax

Many transportation leaders and analysts worldwide agree that wide-area Road Use Charging (RUC), most likely using global positioning satellites (GPS), must play a pivotal role in infrastructure funding, congestion management and emissions reduction in the coming decade. There is some anxiety about how to proceed politically or programmatically since road use charges, whether new or in replacement for fuel taxes, may be poorly received.

Bern Grush, Chief Scientist for Skymeter Corporation, outlines an approach for introducing pay-per-use metering and charging technology into megaregions on a voluntary and consumer-focused basis by offering a suite of services, rewards and incentives while delaying new tolls until full acceptance is gained. The end goal is to replace fuel taxes with a fairer form of payment for road use.

## How will we finance roads in 2020?

We currently pay for our roads with various combinations of fuel taxes, property taxes, sales taxes and spot-tolls associated with specific road segments, tunnels or bridges. In the United States fuel taxes fund less than 50% of the requirement, with individual states varying from that average. Worldwide, this figure may vary, but the trend is the same everywhere – the burden of funding roads, managing congestion and reducing emissions has reaching crisis proportions. The word ‘bankrupt’ has frequently been used to describe the US Highway Trust Fund over the past 2 years.

The move toward fuel efficiency, greener energy and even reduced travel in many countries serves to diminish fuel tax revenue, ensuring that every success in transportation efficiency threatens the viability of the infrastructure those vehicles use. To depend on taxation of the energy source we are trying to abandon absolutely threatens our surface transportation networks. With every increase in transportation demand, capital expense and operating expense, fuel-based funding becomes less sustainable. Without stable and sustainable funding, transportation planning is hobbled and once thriving economic jurisdictions choke on mobility demand. This effect is already apparent in most, if not all megaregions of our six populated continents.

Hence, we are being forced to reestablish a sustainable revenue-base for our road networks. Governments can tax anything they wish. Seeking to minimize political controversy, this may lead to new sales taxes, property taxes, and use of general funds. However, charging for use according to when where and how much is driven opens the door to a powerful demand management tool that can manage productivity-throttling congestion. If we consider vehicle type in a progressive charge calculation we can also speed the change to greener vehicles. Paying for use as detailed in the February 2009 report “*Paying Our Way*” from the US Congressional National Surface Transportation Infrastructure Finance Commission (NSTIFC) can be set up as win-win for all stakeholders. Americans call this Vehicle Miles Traveled (VMT) charging; Europeans call it Time, Distance, and Place (TDP) charging. Add ‘vehicle type’ and it is called TDPV charging – the technology assumed, below.

The purpose of this proposal is to develop a phased transition from the use of gas taxes to VMT charging using TDPV technology. Such an approach must relieve the immediate pressure on legislators and politicians while proceeding to prove the deployment structure for this new funding delivery mechanism.

## Why GPS?

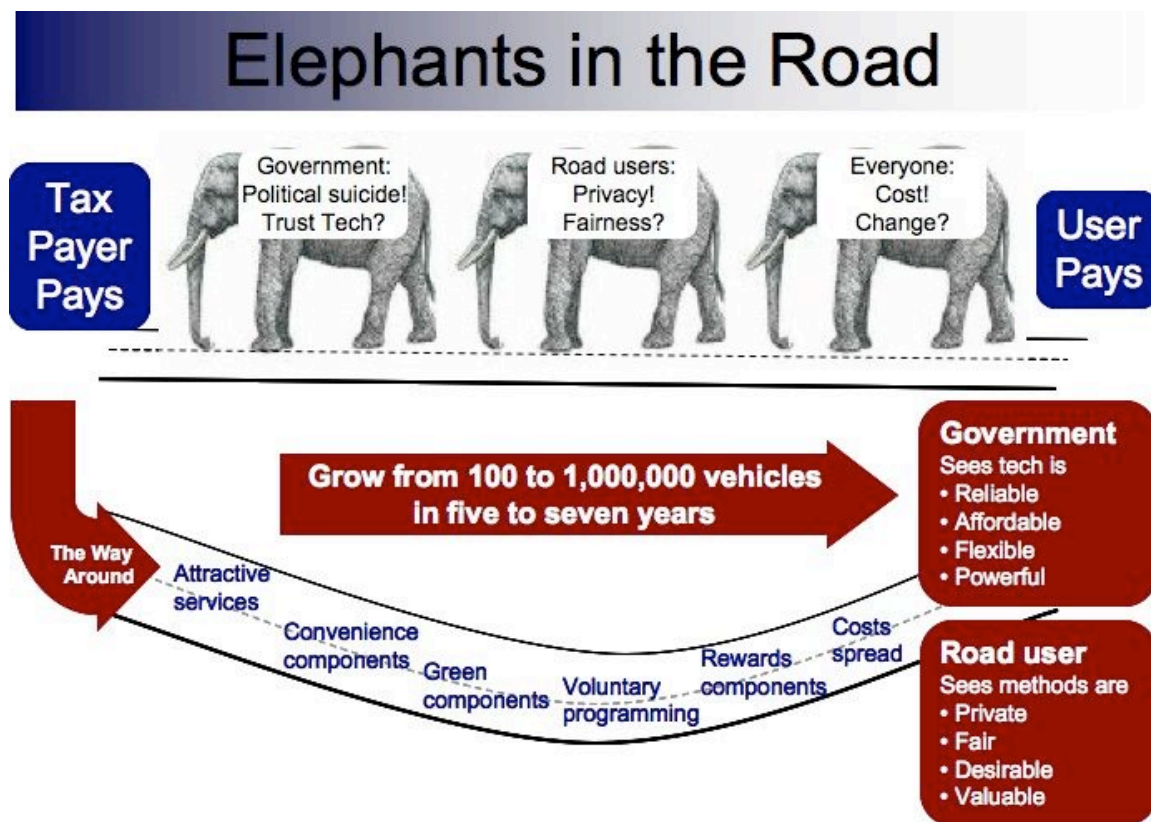
If we intend to replace fuel taxes with user fees, we can do this in two ways. We can capture as many fees as is feasible from critical, limited-access road links – highways, bridges, and tunnels. This is what we do on a limited basis now. In future, we could put up as many toll plazas as we

reasonably can fit onto the landscape. We can photograph license plates in central business districts and at toll plazas (if you do not have a transponder), noting that this unnecessarily compromises privacy. This would be cluttered, unattractive, and expensive (it would be very difficult to halve the 20-40% expense from revenue which is the experience until now). It will be unfair since it will re-route traffic into residential neighborhoods, and provides free access to vehicles who might avoid using the tolled infrastructure subset. It will also be unsafe as it re-routes heavy trucks to underperforming and under-designed pavement and smaller parallel roadways. While this approach can incorporate time, and place variation, it is weak for distance and vehicle type variations.

Alternatively we can use self-enforcing, private, in-vehicle charging telematics systems based on anonymous, financial-grade GPS (FGPS) technology to charge everywhere required and with whatever variations are needed to manage transport demand. These newly available road and parking-use metering systems can be made far cheaper, more private, more effective, and more attractive to motorists than the current infrastructure-heavy, short-range radio technologies.

### What is needed for acceptance?

There are four immediate barriers to acceptance of this second, economically efficient alternative: governments and private infrastructure owner/operators do not trust that these new telematics technologies work and that their revenue will be secure; motorists do not trust that such methods are fair and will protect their privacy; the cost to distribute and manage in-car metering devices is assumed to be high; and there are many reasons that the process to put adequate legislation in place will be protracted, especially the development of pricing schema to ensure equity among vehicle types, between rural and urban drivers, or between commercial and private vehicles.



**Figure 1:** Rather than force a change (stick), build a set of attractive services and reward programs (carrots) and avoid many of the greatest difficulties.

To address each of these four barriers, this proposal provides, respectively: a gradual path to earning the trust of infrastructure operators by operating in-vehicle metering for hundreds of thousands of users over a few years (several billion miles); it will gain the trust of road users by developing fair incentives for use and by never compromising privacy; it will illustrate a way to reduce costs to the level of current costs or lower; and it provides for a long and active lead time for governments to provide any required legislation – including the pricing schemes that will be needed in time for fuel tax replacement.

The transitional program proposed, here, accommodates all stakeholders – including those resisting this change and municipalities or states with pre-existing investment in current road and parking tolling methods. The following design assumptions are made:

Motorists dislike mandated taxes or charges	Avoid early additions of road tolling fees
Motorists tend to view market pricing for roads and parking as an unfair withdrawal of entitlements	Make participation voluntary as long as feasible
Motorists will pay a premium for a higher level of services and conveniences	Include as many of these as is possible in the system
Motorists will participate in loyalty and discount programs	Include as many of these as possible in the system
Motorists grow accustomed to convenience and prefer to not to lose it	Focus on a high level of service (unlike current customer service for parking and road-toll payments)
Motorists will be slow to trust anonymity claims made for a GPS-based payment platform	Plan for a gradual route to pervasiveness for the new technology and attrition of the old
Governments require extensive proof that in-car revenue-collection systems are reliable	Leave existing payment systems in place until full conversion
Governments require undiminished net revenue	Provide a low-cost operational path
Governments prefer to spend less to achieve the same revenue	Provide additional cost-offsetting opportunities
Governments prefer not to mandate new taxes	Attract motorists by offering increased service levels; while paying the same as non-participating motorists
Governments require concurrent operation of existing and new technologies	Delay mandatory use of new systems; continue old systems until the new are pervasive

## Why megaregions?

The 21<sup>st</sup> century commuter generally travels through several municipalities within a mega-region, and less frequently outside of that mega-region. The pinnacle of payment convenience for a driver is to have every charge or toll for parking or roads handled without thought or effort – just as fuel-taxes are paid now. This proposal includes driver credits and rewards, that should be widely collectable and redeemable throughout the typical area of travel. Since parking services are an important component, it's best if they are available throughout. The principle of wide distribution or general availability is critical to success, hence requiring *eventual* majority-participation from municipalities in a mega-region. Such general availability attracts multiple cellular operators, insurance providers, private parking operators and payment services operators, which brings the advantages of commercial competition, private investment, new services, and public acceptance.

## The deployment approach

In order to achieve economic efficiency and promote social acceptance, the proposed service model is a *mobile-phone service model* rather than a traditional telematics device sale. Vehicles would be equipped with road use meters for monthly metering and billing services based only a security deposit and monthly minimums.

Logistically, governments need not purchase transponders or build infrastructure, thus removing capital cost barriers. Road operators, parking operators, and insurance companies would subscribe to privacy-assured payment services set up in the same way as mobile telephony services, providing for the cost of in-vehicle metering devices to be rolled into modest monthly service minimums.

## Five Deployment Stages

As technology hurdles recede, there remains a body of social, political and operational concerns. Will this be fair and private? Will rural motorists be treated equitably? Will costs be reasonable and operations reliable in large volumes? How well will enforcement work? Will the meter evidence be useable to defend a bill? How will motorists adjust to this change?

The emphasis on a broad service spectrum is to attract motorists and multiple private partners to lower costs of both tolling and parking management. Gas tax collection in the US currently consumes about 1% of revenue. We can only expect to match this with onboard telematics by providing many other secure and valuable services concurrently. Imagine an onboard payment service that offered so much value that a majority of motorists actually *desired* one?

The emphasis on a voluntary-plus-rewards approach eases fears and attracts motorists rather than repulse them with new taxes, as has been demonstrated in the Netherlands.

Parallel programs such as expanded public transportation, cycling, carpooling or subsidies to move closer to work are also critical and the public debate that must necessarily accompany these changes may speed up or delay the progress of the project outlined below.

This proposal includes five project stages: Prep, READY, SET, GO, and Going. At every stage, third-party tests would decide how to proceed, hence there is considerable flexibility designed in.

### PREP

PREP demonstrates new capabilities and sets expectations for stakeholders. Payment for FGPS-metered road use is novel socially and politically, so programs start gradually and provide other benefits first. PREP is overseen by a regional DOT to allow transportation professionals and lawmakers to see the capability first-hand.

A PREP demonstration is a two or three week project from design to final report, showing charging or other metered driving and parking results within a mega-region.

This demonstration is followed by a three or four month, 100-vehicle study to examine any number of issues including: (1) the effect of driver rewards on modality choice; (2) the acceptability of paying for parking from debit or credit accounts; (3) the reliability of carbon footprint measures; (4) the ability to preserve anonymity of driver as well as vehicle location; (5) the ability to manage parking cash-out programs; or any other that the regional or municipal DOT or parking authorities may choose. The vehicles might be car-share vehicles, or government employee vehicles, or might all use transit lots.

The PREP study provides a critical *proof of capability*. Privacy, reliability, consistency, and repeatability are demonstrated in the chosen application context and the system is shown to be robust and scalable for the next stage of investment. The study must leverage as much information as possible to contribute to policy thinking that will inevitably inform the following stages.

The successful implementation of PREP requires a meter operator and project manager, a steering committee that includes the initial municipality involved, and a project manager. PREP also requires funding from the region/municipality.

### READY

Following the success of PREP, READY is a wider-scale implementation, which offers significant payment services, and real rewards focused on measurable modal-choice change, for a few thousand vehicles. The first purpose of READY is to garner critical public support.

Secondly, READY is a “discovery-focused” process *for governments* and is designed to demonstrate unequivocally the enormous policy potential of FGPS-based vehicle use metering and to understand the operational and business aspects of this approach. READY would:

- Demonstrate that existing road, tunnel, and bridge tolls can be tolled consistently

- Demonstrate the viability of 'hands-free', ticketless parking payment
- Demonstrate carbon-reduction incentive programs for large employers
- Demonstrate that a significant portion of motorists would, given rewards, choose to use other modalities, shift travel time, telework, or carpool
- Collect aggregate trip data to study the proper settings of future mileage-based fees for vehicles for tolling and insurance, as well as per-minute parking fees
- Determine operational challenges for full roll-out, such as signage, enforcement, fraud prevention, telco support, distribution/spares/repairs, customer support etc.

Thirdly, READY provides *motorists* with an opportunity to see conclusive demonstration of privacy, anonymity, fairness, convenience, reliability, green-rewards, social benefits, reduced overpayment for parking and insurance, and easier travel accounting. READY would:

- Permit collection of any *existing* tolls via FGPS metering (no new or increased tolls are proposed)
- Permit a substantial number of parking spots to be payable by FGPS metering, *without a change in parking fees*, except that pay-by-minute parking is provided as an attractive feature
- Offer ticket-free parking such that if a vehicle overstays the intended time limit for street parking, that vehicle would begin to pay more per-minute from the moment overstaying begins
- Offer credits to motorists who abstain from peak-hour driving.

Historical projects such as the Puget Sound Regional Council pilot demonstrate that motorists respond to pricing signals, and the PREP stage of this work will have shown that a FGPS meter is capable and effective. Hence, there is no need for further *technology* pilots. READY is a *business effectiveness pilot* designed to show that FGPS-based road use metering is a liability-critical system for toll and charge collection. READY answers: "What is the operational business model that allows replacement of the fuel tax?"

READY requires a meter operator, billing operator, project manager, and a steering committee from the regional DOT, environmental authority, and the participating municipalities.

It is critical that READY be partially self-funded. From the outset, FGPS road use metering can bring multifaceted services to relieve the taxpayer of undue burden. Agreements with participating parking authorities for which this technology enhances revenue and reduces costs can be targeted to offset 25% of costs.

## SET

Following a successful READY, SET extends the "discovery-focus" with 100,000+ vehicles. SET adds new pricing and reward components and pushes the mega-region closer to deployment of FGPS-based VMT charging. SET would:

- Establish a regional commitment to addressing infrastructure funding and traffic congestion
- Stress-test every component of usage-based payment services with autonomous, wireless meters in an operational, GPS-based service environment second only to Germany's
- Incorporate multiple billing-operators, providing user choice and competition
- Include most regional municipalities to ensure a high degree of service availability to the motorist and a maximum source of revenue
- Offer parking payment services across most municipalities to make parking convenience pervasive and attractive to meter users
- Enable parking pricing best practices to achieve time sensitive 15% vacancy for street

- parking (reducing congestion from *cruising*)
- Enable charging for parking on municipal and residential streets where parking is currently too expensive to manage with curb-side equipment
- Enable re-distribution of payment machines for management in places that are now free or tire-marked.
- Enable municipalities to address parking spillover

SET builds *public acceptance* by allowing motorists to experience TDPV charging as fair and private, and by appealing to motorists' desire for mobility services, convenience, and green-rewards in order to ease the eventual transition from tax-payer-pays to pay-as-you-drive.

SET builds *government confidence* by providing a low-risk testing ground for reliability of FGPS metering and sets the stage for a full rollout by determining what needs to be done to have this work throughout the mega-region.

SET requires a project manager, a meter operator, a billing operator, as well as an enforcement coordination to detect payment evasion. It requires the same steering committee as READY with increased representation of regional municipalities as they become involved.

SET can begin to provide marketing capabilities that add value for motorists and further reduce the need for subsidization. Programs such as location-based SMS coupons delivered to cell phones, parking loyalty agreements and parking coupons for retail promotions can be deployed.

SET will increase its self-funding component to 50% or more because of increased volumes, more services and more participating parking authorities.

## GO

GO is a full, region-wide, "go-live" stage. GO would:

- Be fully self-funding
- Deploy in 1,000,000+ vehicles (or 25% of the registered vehicles in a mega-region)
- Be a significant revenue conduit for the mega-region
- Encourage the motorist and government trust needed to replace the gas-tax
- Be a model for a nation to prepare for use of FGPS technology to charge for infrastructure use whether via cordon, area, segment or VMT schemes
- Enable attrition of existing parking metering technology
- Enable phased programs to diminish or exclude free street parking on public and residential streets (residents optionally excluded)
- Allow private parking operators to subscribe for these payment services (as municipalities begin to exclude free parking and spillover for public areas, parking abuses will likely increase on private property)
- Permit a massive shift to PAYD insurance, contributing to safety, diminished congestion and reduced VMT
- Add new parking services, specifically *parking-finders* to further reduce circling and attract users
- Prepare a megaregion or nation for replacement of the fuel tax

GO would develop from READY and SET as an independent, self-funded regional entity that manages metering, billing, collection and enforcement on behalf of multiple municipalities, parking operators and insurance companies operating within a megaregion. GO would require a Board for governance purposes and would be independently audited on behalf of its many stakeholders.

## GOING

With an extensive installed base in place, a regional or state government can now offer road users a choice between fuel taxes and VMT charges with appropriate rewards or rebate programs. This

may be voluntary for some vehicle types or mandatory for others (e.g., hybrid plug-ins or all-electric). A transitional program to phase out gas taxes can be set out and a method to manage the dwindling number of legacy vehicles would be determined.

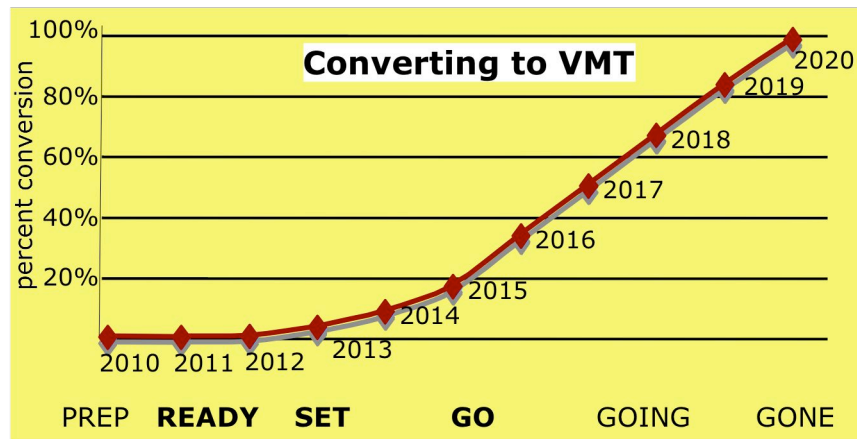
## GONE

In order to achieve a 2020 switchover to VMT charging, and assuming a 2010 start with reasonable rollout of each acceptance-building phase, a calendar schedule for a mega-region might be:

Phase	Timeframe	# cars	Focus
Prep	2010	100+	Set expectations
<b>READY</b>	2010-2011	~5,000	Discovery; Business effectiveness
<b>SET</b>	2012-2013	~100,000	Reliability; Trust
<b>GO</b>	2014-2015	~25%	Readiness to fund transportation programs
Going	2016-2019	~50%	Start replacing gas-tax
Gone	2020	99%+	Phase out gas- tax

**Table 1:** Summary rollout all phases. Actual schedule could be more aggressive.

Of course such a program can be accelerated to suit any appetite for change, and repeated for each mega-region. Hence these stages must leave ample room for flexibility. Although one can imagine this rolling out in 3 or 5 years, it has been scaled here to 2020, in order to match the timetable suggested by the US Congressional National Surface Transportation Infrastructure Finance Commission.



**Figure 2:** Each stage of this proposal takes a megaregion closer to paying for road use instead of paying for fuel taxes. The dates are shown to fit the NSTIFC and AASHTO nominal schedules.

## Conclusion

Faced with an inescapable need of governments to abandon the gas-tax as a critical funding mechanism, it is possible to begin a staged program of payment services and driver rewards to introduce acceptable road-use metering programs. While initially making few or no adjustments in charges or tolls for roads, bridges and parking, governments can gradually increase or permit those services and inducements until these metering systems become pervasive. Along the way, increasingly sophisticated parking services, PAYD insurance, and modality choice rewards continue to attract users interested in services and earning rewards. This approach can build trust on the part of road users as well as on the part of toll operators, while building the installed base of systems needed to make the necessary shift from gas-taxes to “Paying Our Way”.

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