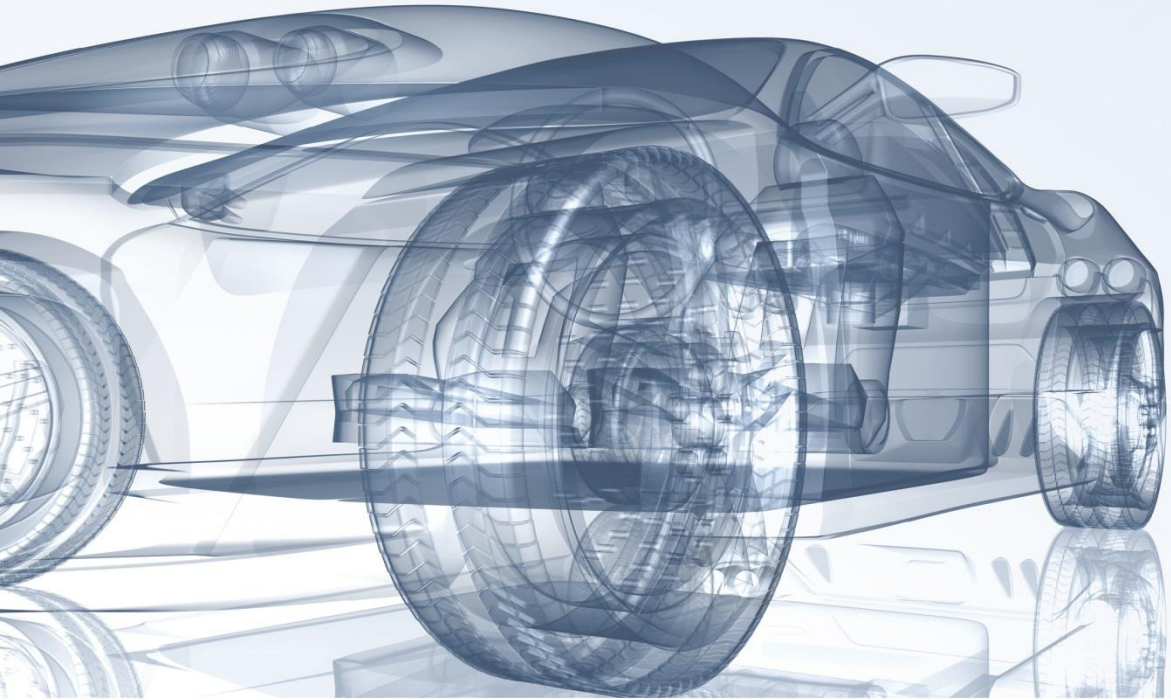
evs 30



The 30th International
Electric Vehicle
Symposium & Exhibition

October 9–11, 2017

Messe Stuttgart, Germany

www.evs30.org

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Electrifying emerging markets: the case of Costa Rica

Bjørn Utgård
Founding partner, ESCOIA

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Acknowledgements

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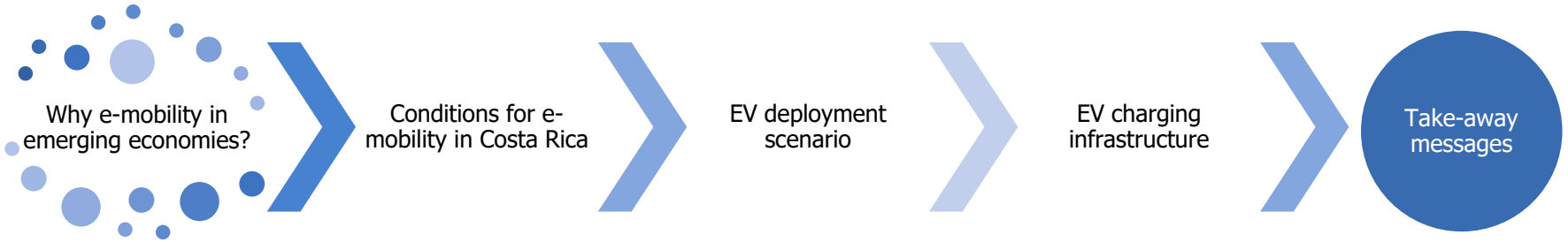
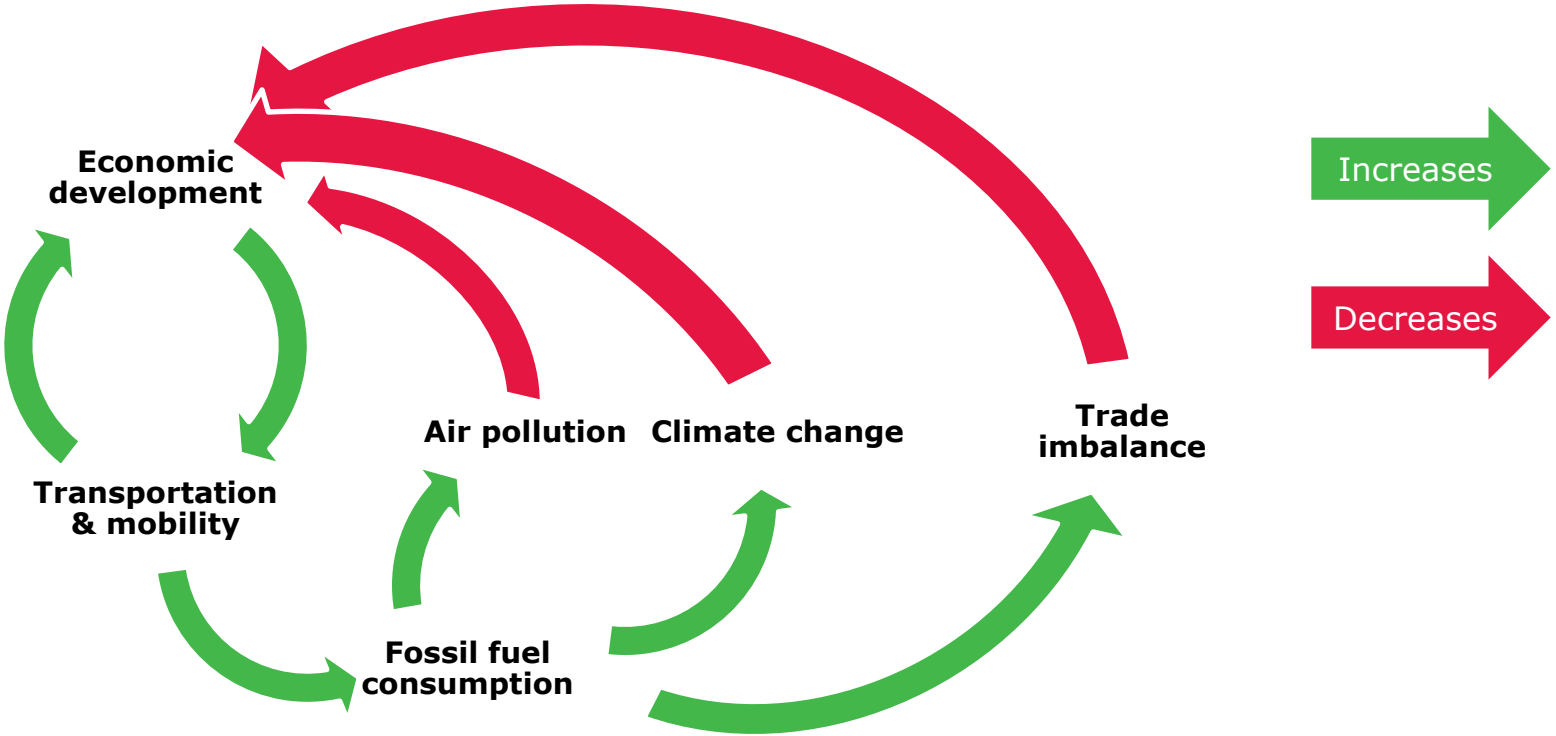
Agenda


Why e-mobility in emerging economies?
Conditions for e-mobility in Costa Rica
EV deployment scenario
EV charging infrastructure
Take-away messages

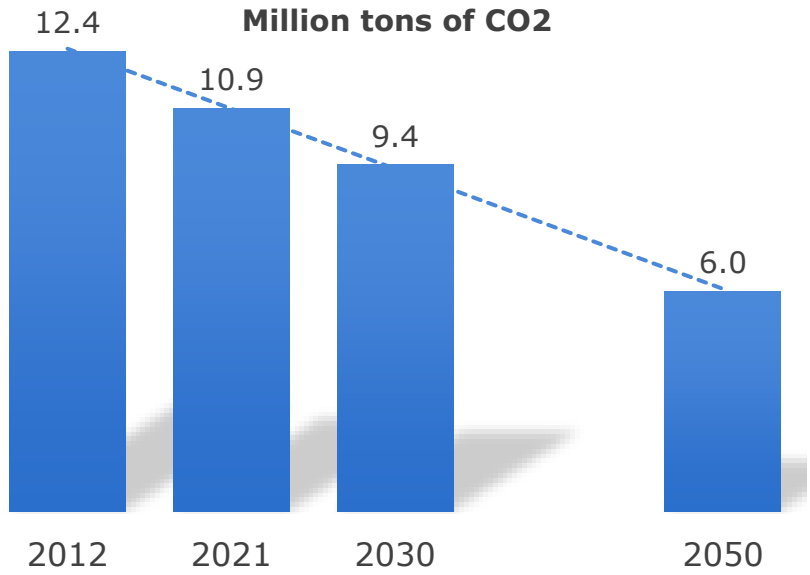
The transport <-> economic development conundrum



Cleaning up transport is vital for both local and global reasons

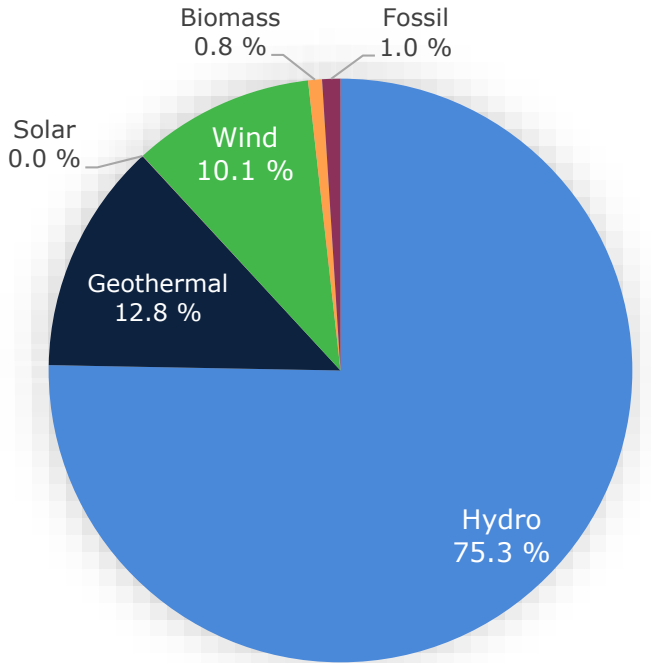
Cleaning up air quality and improving health

Meeting Paris climate commitments

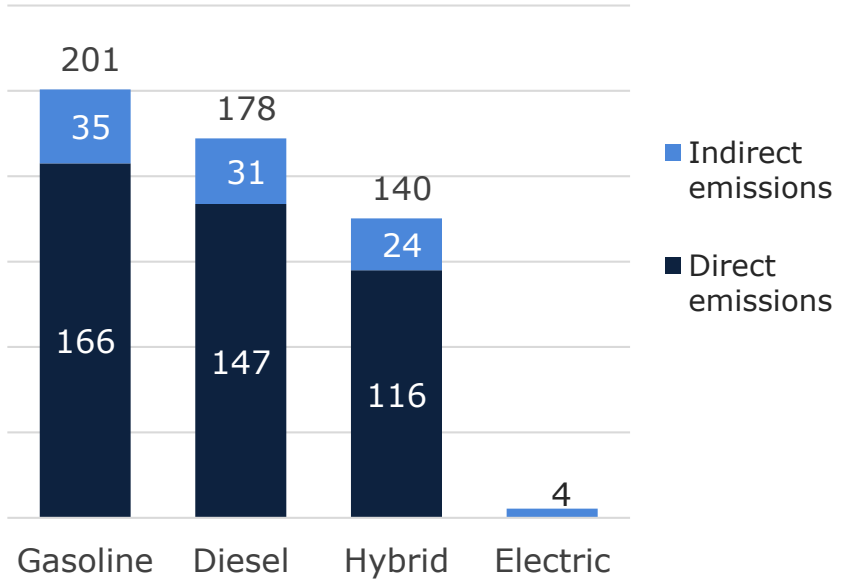


Nearly 100% renewable electricity → **EVs eliminate even indirect emissions**

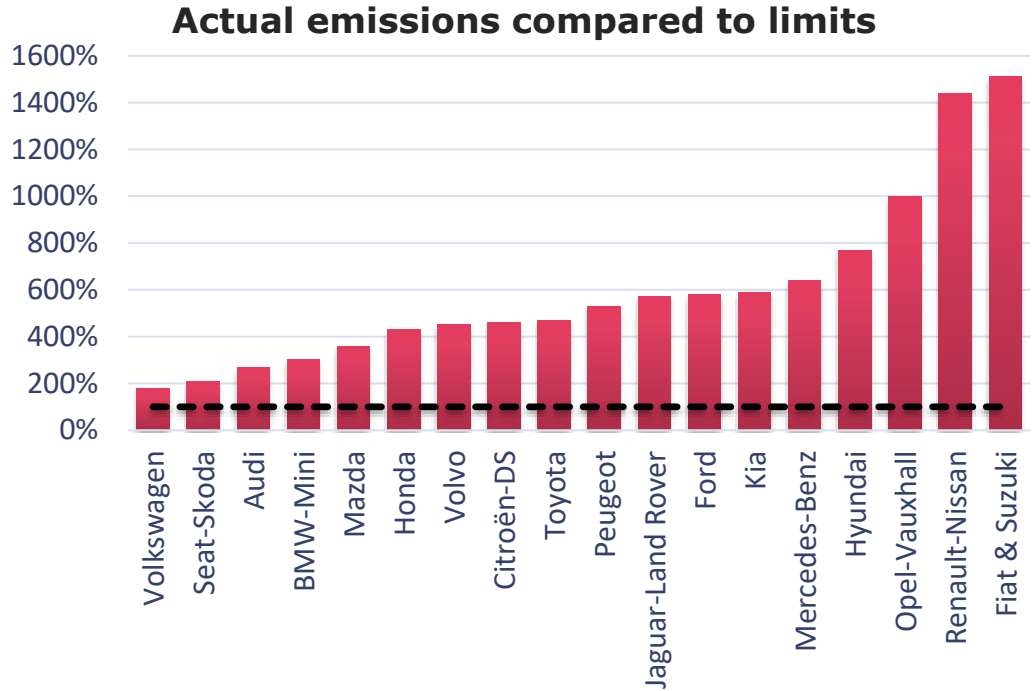
Share of electricity generation (2016)



Well-to wheel emissions (gCO_2-eq/km)

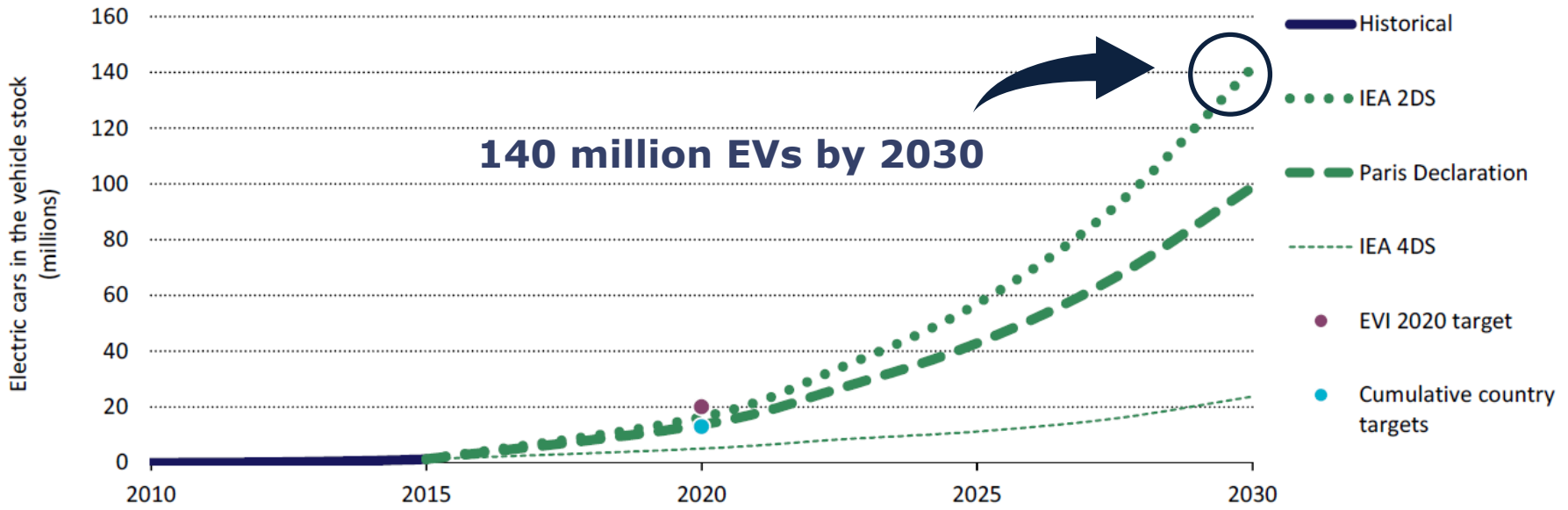


False hope: clean fossil fuels



Source: Transport and Environment. “Dieselgate: Who? What? How?” Brussels, Belgium: Transport & Environment, September 2016.

IEA: 140 million EVs by 2030 required to limit average global warming to 2C



Source: IEA. "Global EV Outlook 2016. Beyond One Million Electric Cars." Paris, France: OECD/IEA, 2016.

Costa Rica: perfectly positioned to lead on e-mobility?

- 100% renewable electricity
- Culture of environmental stewardship
- World-leading eco-tourism destination
- Ambitious climate commitments
- No domestic petroleum

How quickly could Costa Rica deploy electric vehicles? Developing a Costa Rican EV deployment scenario

Method

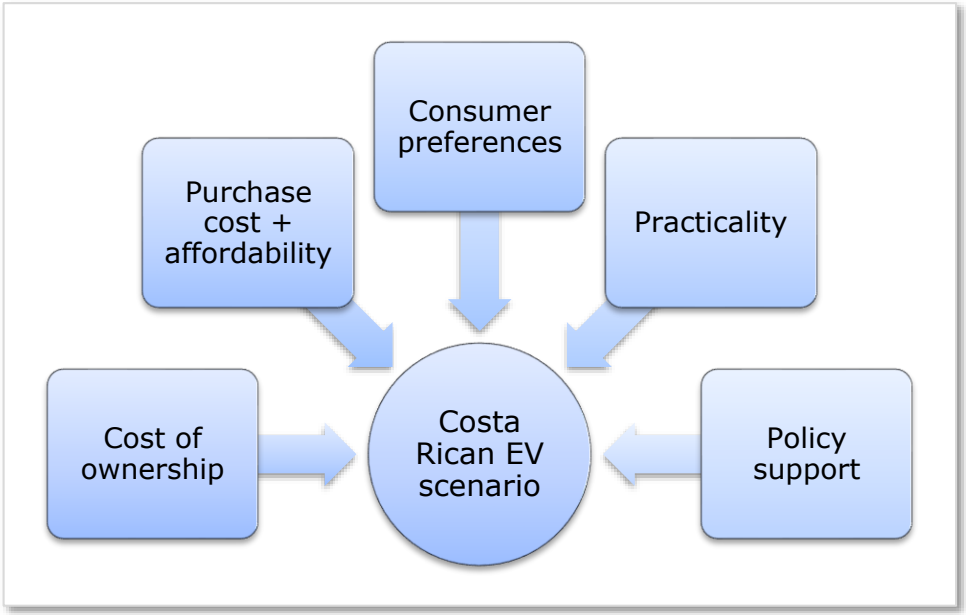
- Qualitative and quantitative study of a wide range of conditions in Costa Rica
- Stakeholder interviews and consultations
- Comparison with conditions in Norway to identify drivers and barriers

Approach

- Constructive: seeking out strategies for overcoming barriers
- Comprehensive and holistic

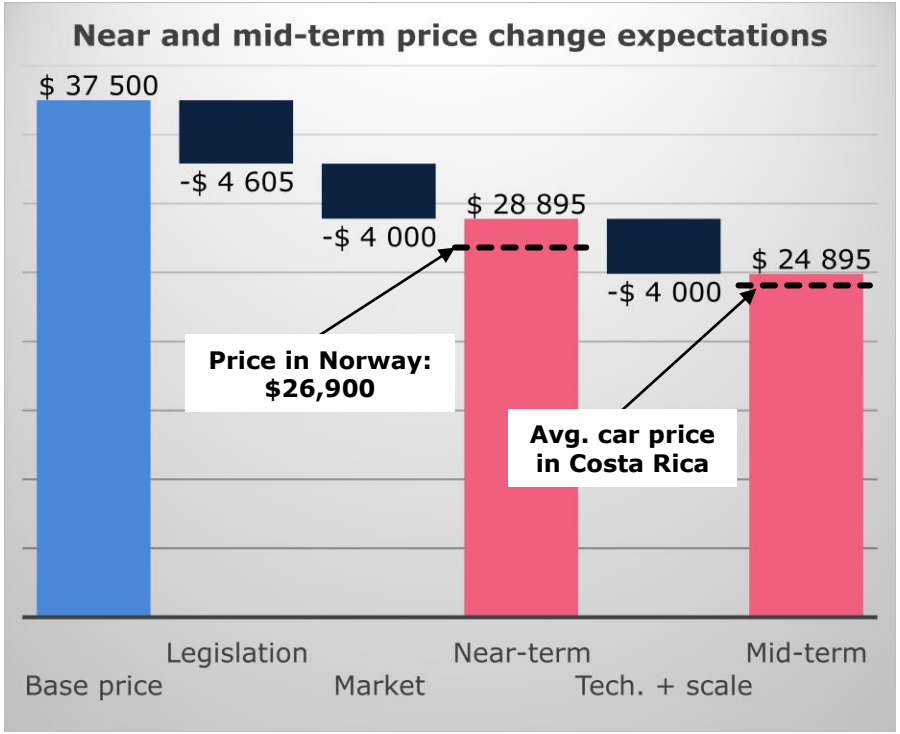
Limitations

- Supply-side constraints are to a large extent dependent on international industry decisions and trends

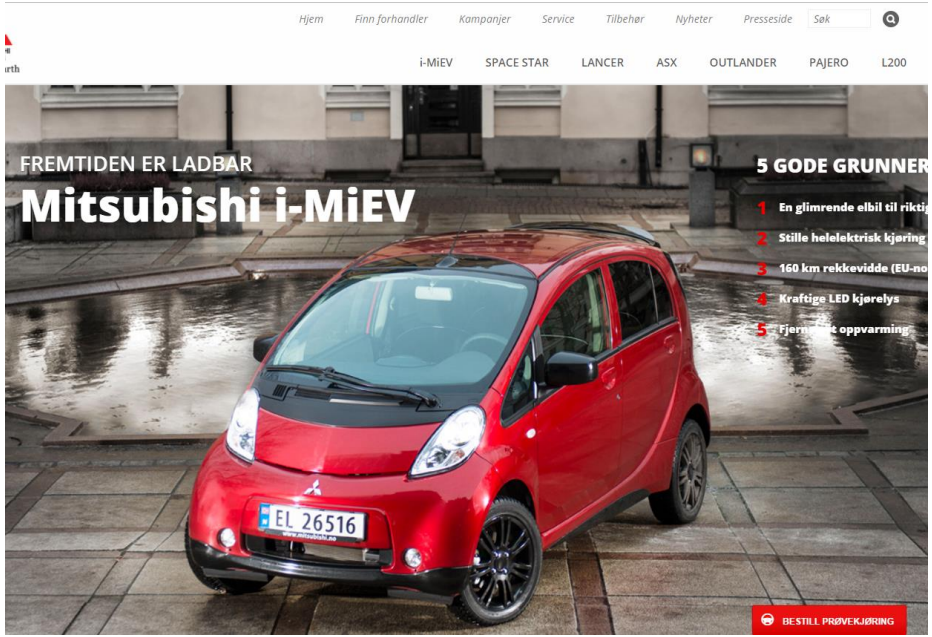


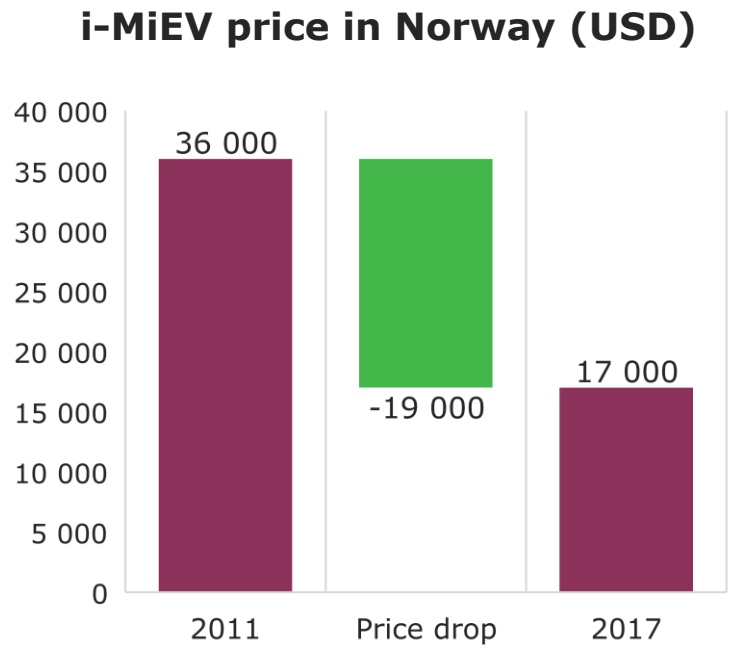
Cost of ownership:
Fuel savings = $1,000-1,200 per year

Cost of acquisition and affordability
Example: Hyundai Ioniq



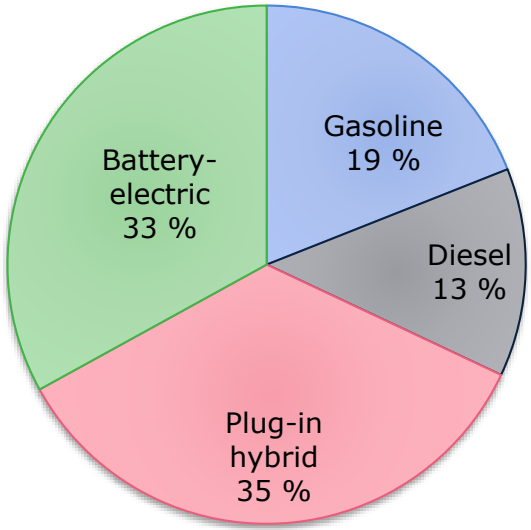
Acquisition cost quickly dropping due to manufacturing savings + competition (example from Norway)



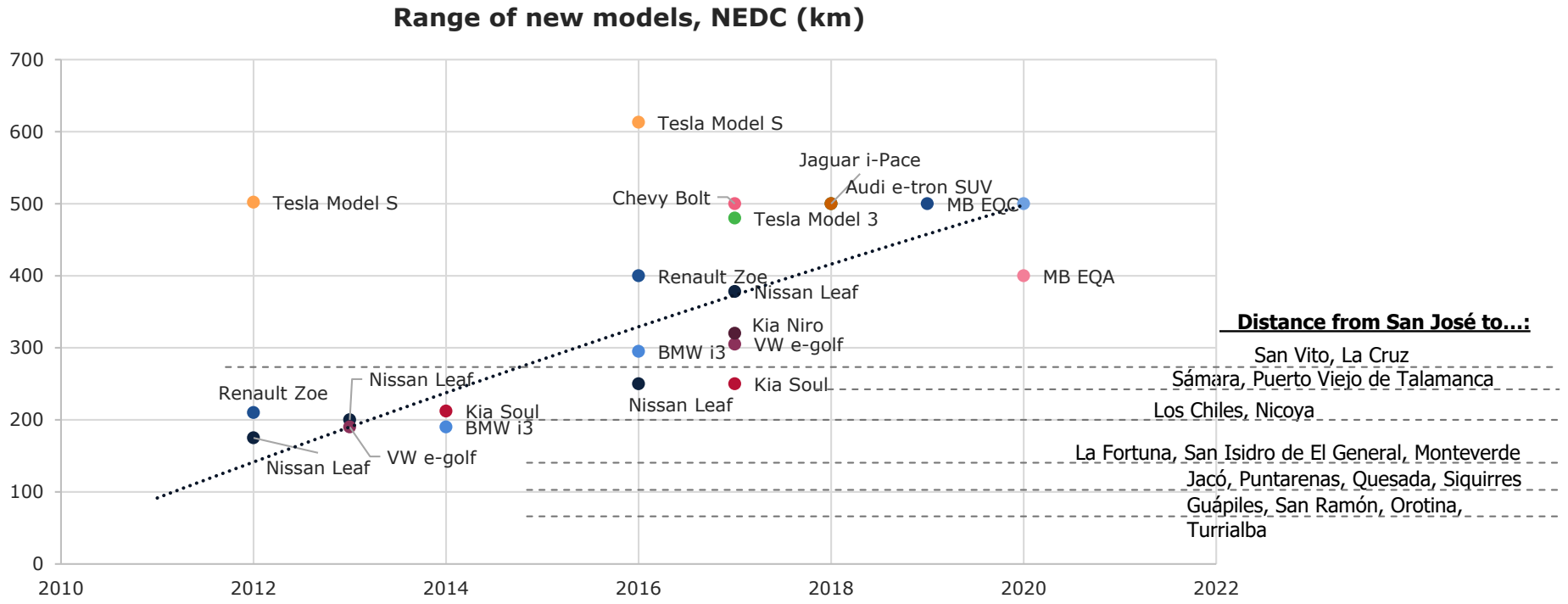


87% of Costa Rican's surveyed in 2016 said they would prefer an EV if it would cost the same

Example: VW Golf sales in Norway in 2016



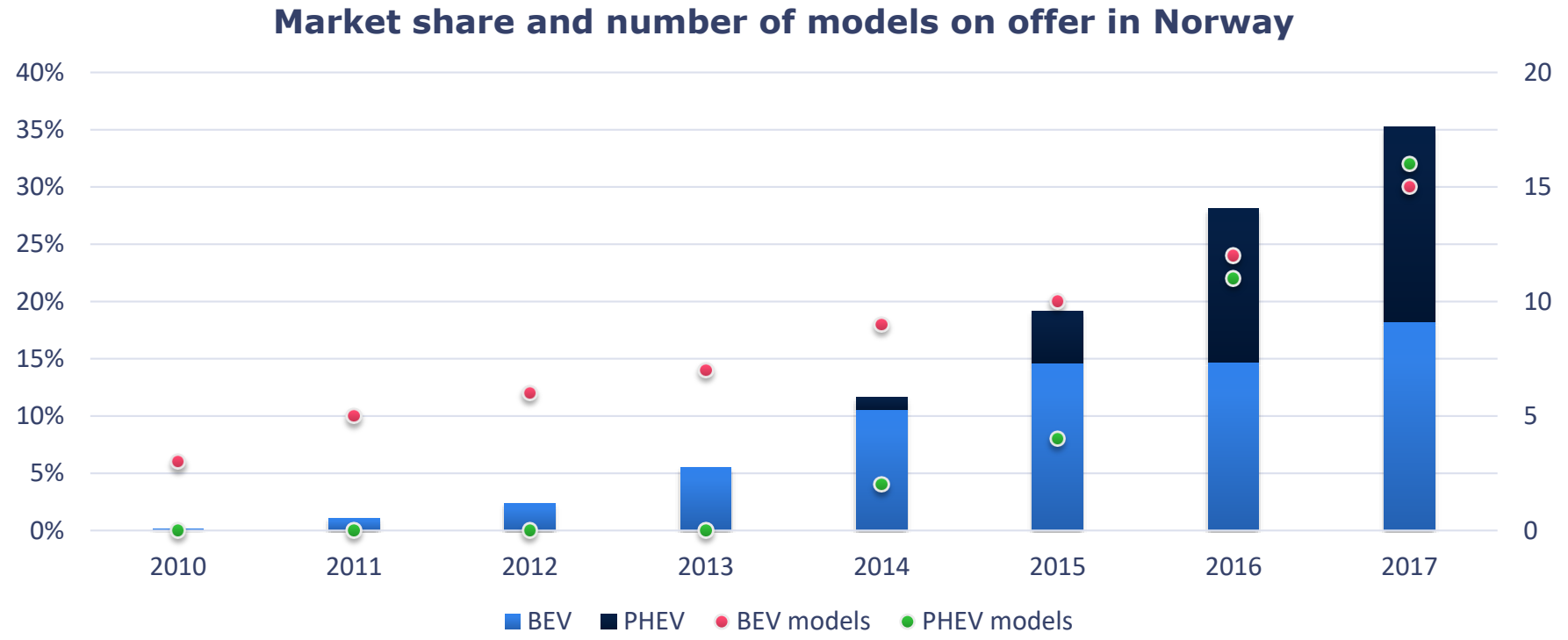
Ranges of new EVs are sufficient for reaching all corners of the country with minimal fast charging needs



Policy support?

- Existing decree
  - Exonerates the 30% fuel consumption tax for battery-electric vehicles
  - Where ICE vehicles pay ~47%, EVs pay ~17% in total taxes at point of sales
  - No circulation restrictions
- Law proposal on the senate floor
  - Exonerate remaining purchase taxes (~17% in sales and import tax)
  - Eliminate annual road use tax for 5 years ("marchamo")
  - Mandate utilities to establish charging infrastructure
- 25% reduction in greenhouse gas emissions by 2030:
  - Not possible without zero-emission transport solutions

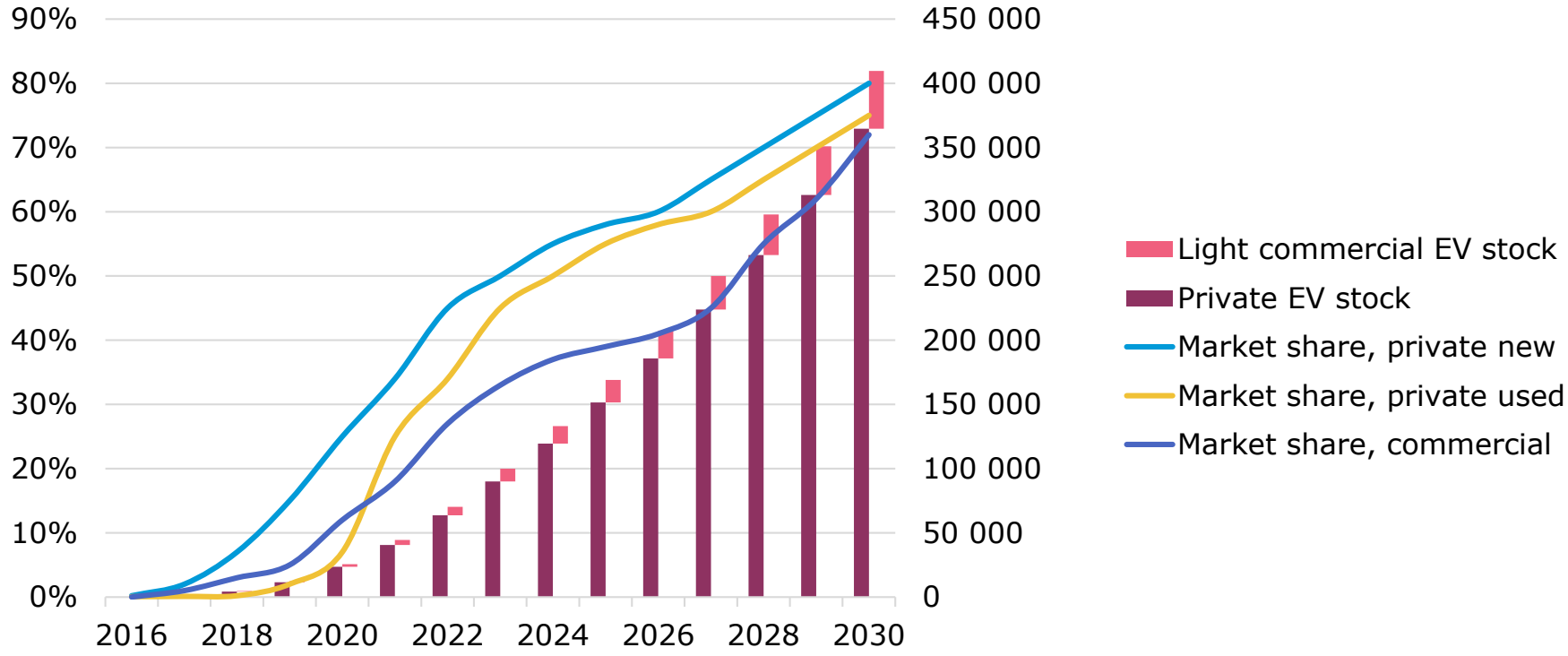
Will vehicle importers raise to the challenge?



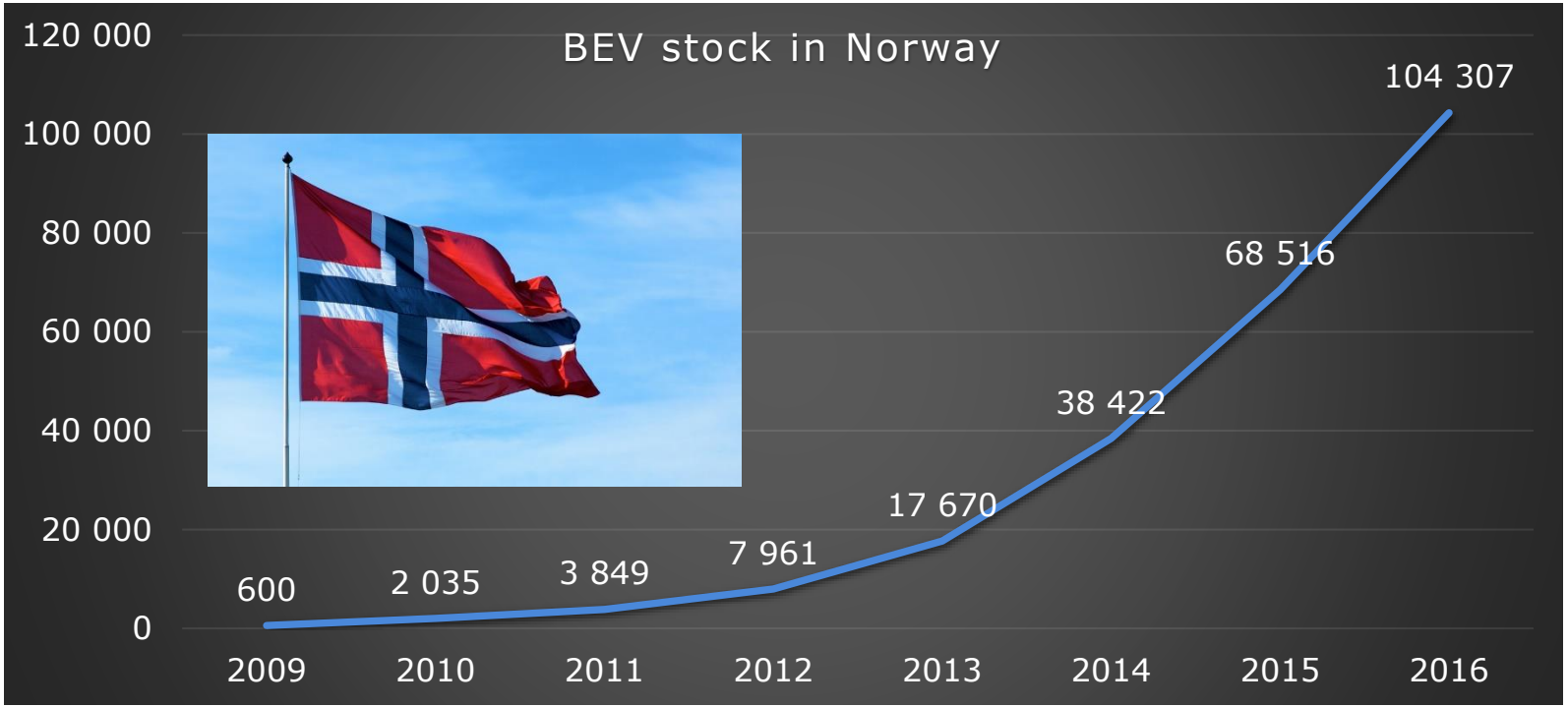
Summary: conditions for e-mobility in Costa Rica are excellent

Factor	Norway	Costa Rica
Fuel savings (15,000 km/y)	$1,750	$950- $1,150
Oil change interval (km)	15,000	7,500
GDP/capita	$62,084	$15,595
Avg. new car price incl. tax	$45,000	$22,000
Environmental awareness	High	High
Climate commitments	Ambitious	Ambitious
Renewable electricity	98%	99%
Inhabitants/km	14	95
Homes with private parking	62%	93%
Number of filling/service stations	1,580	346
Distances: North-South x East-West	2,500 km x 600 km	500 km x 400 km
Topography	Hilly	Hilly
Average temp.	4.3C	24.7C

EV deployment scenario



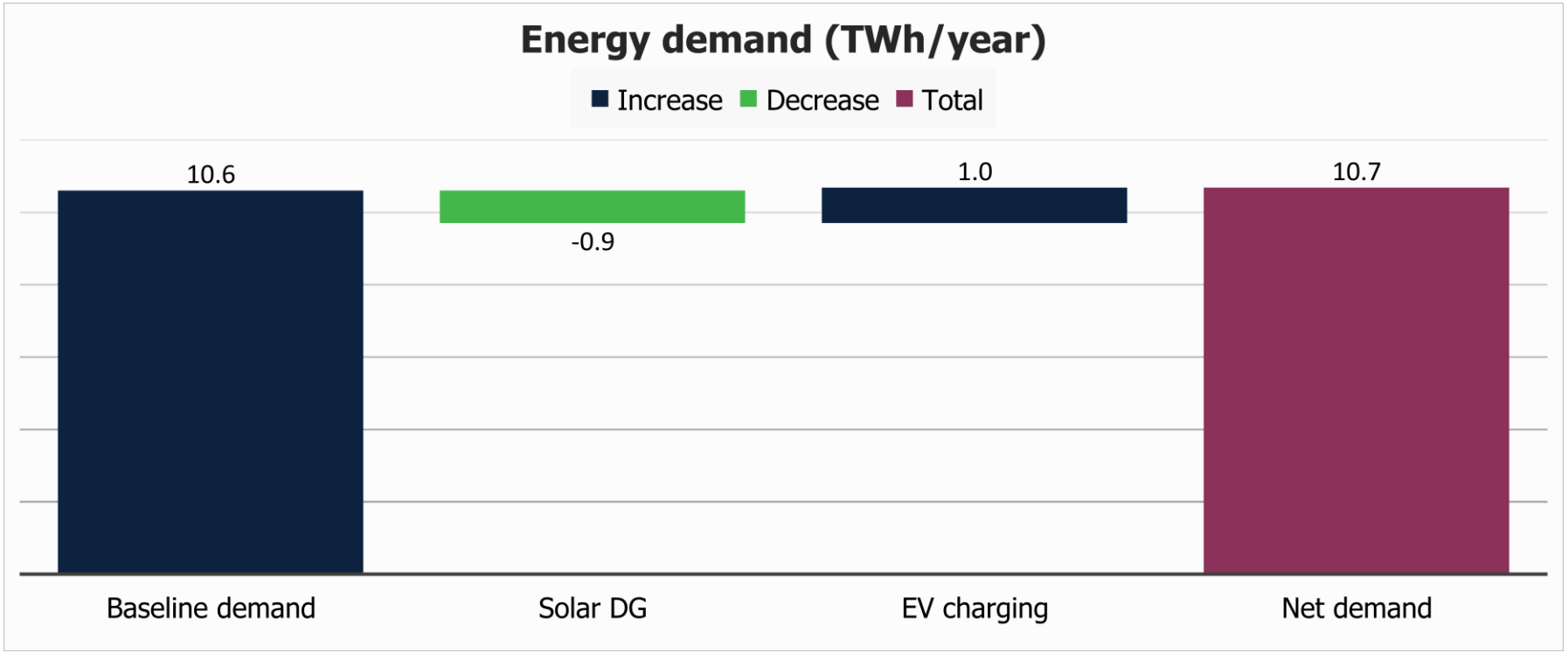
Reality check…



Outcomes by 2030

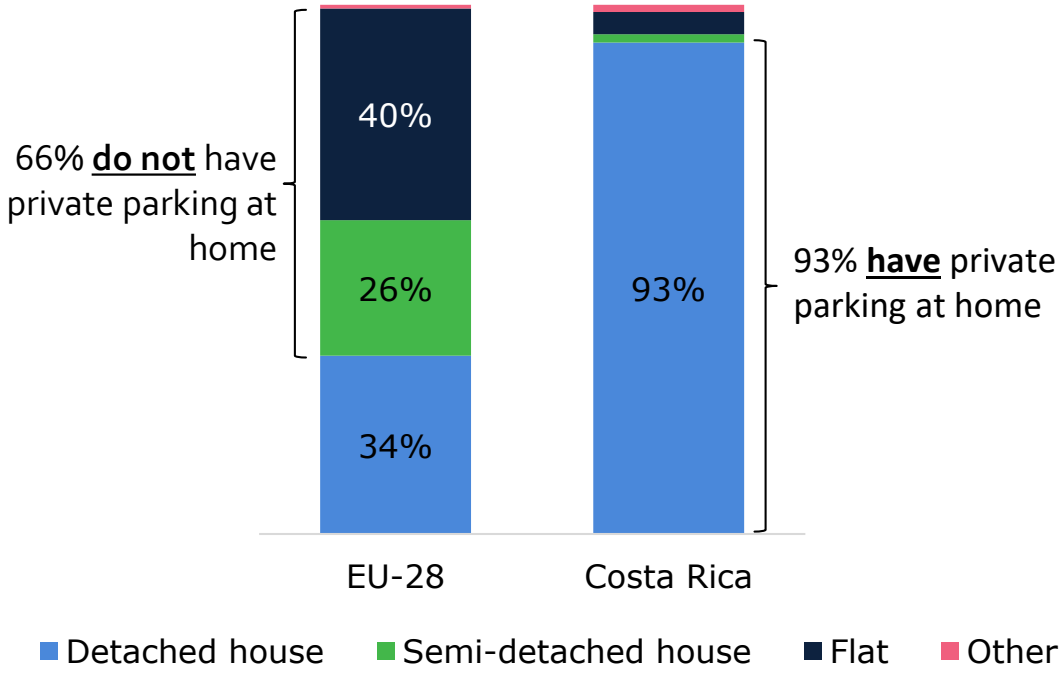
Private and light commercial vehicles	Gasoline and diesel imports	Greenhouse gas emissions	Electricity consumption
• 410,000 electric vehicles in 2030	• Reduced by 2.5 million barrels • Improving trade balance by 175 million USD per year	• Reduced by 920,000 tons per year • 30% of required reduction by 2030	• 9.3% increase • Compensates for demand lost due to distributed generation (solar)

EV charging makes up for expected demand loss due to increase in behind-the-meter distributed generation

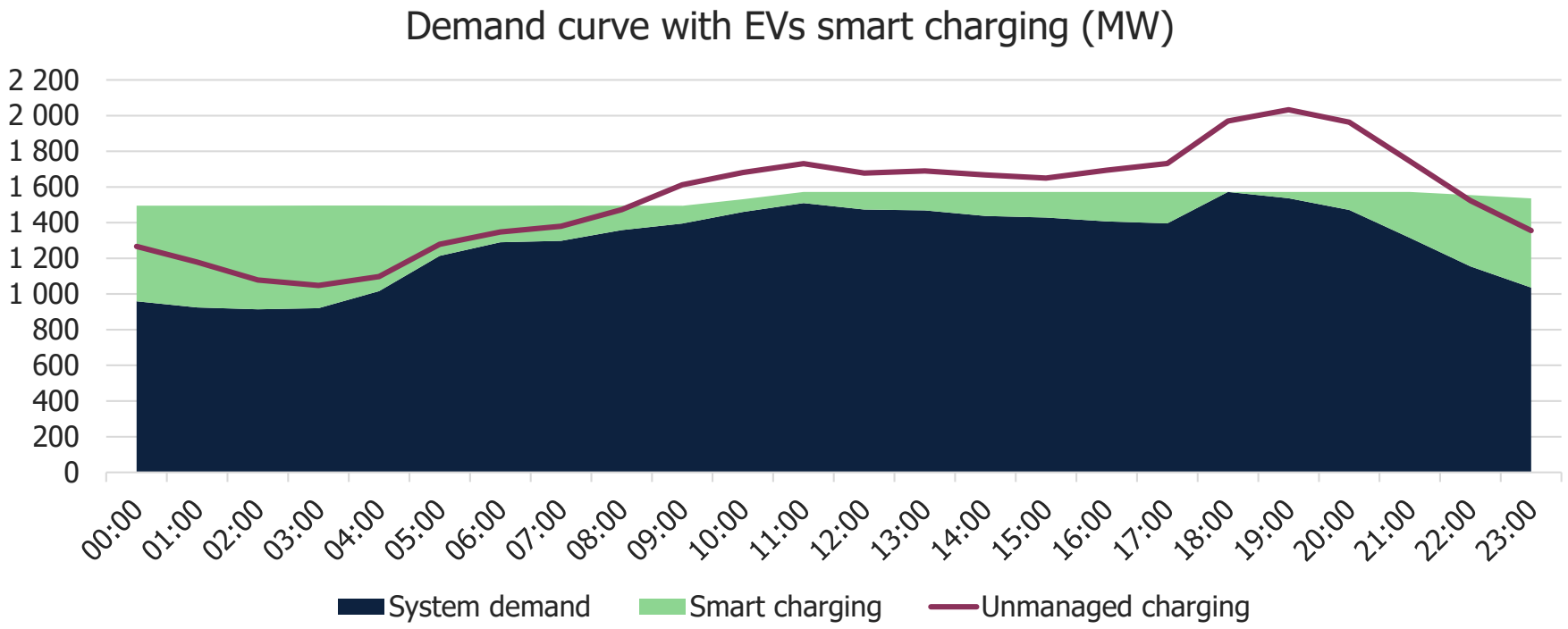


93% of Costa Ricans live in detached homes

Home charging will completely dominate

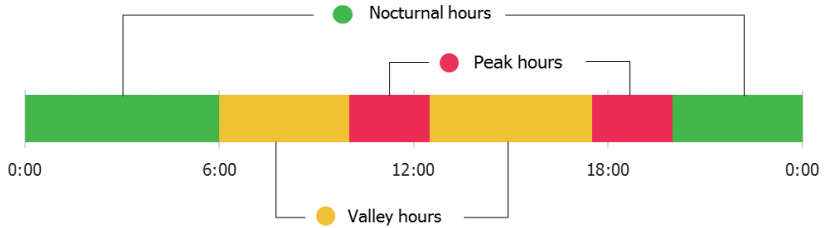


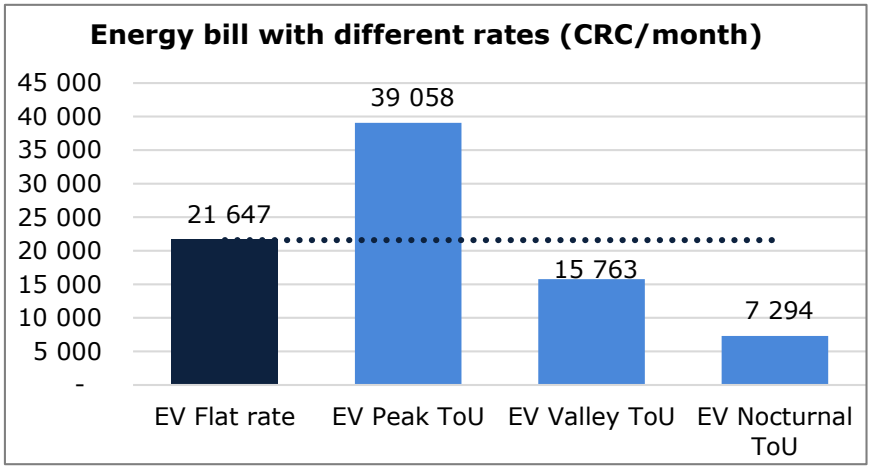
Smart vehicle charging is key to avoid increase in peak power demand

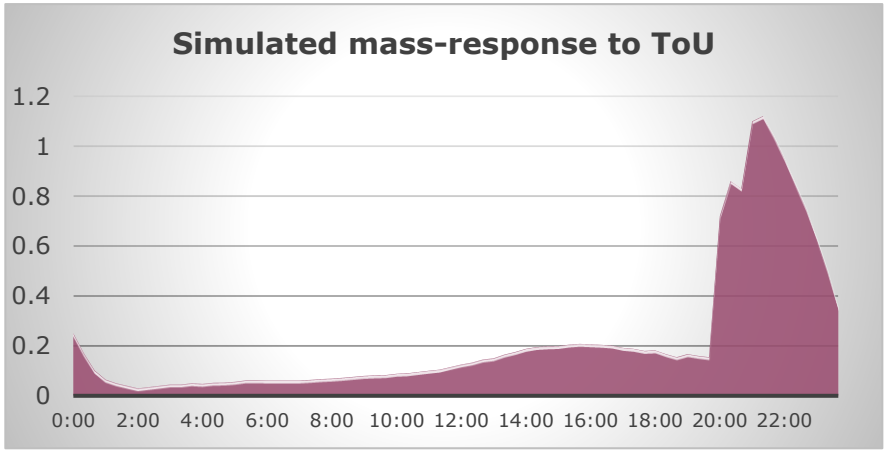


Smart home charging: User-controlled incentivized by Time-of-Use (ToU) electricity tariffs

- ToU tariffs are available for 38% of residential consumers
- Plan to make ToU nation-wide
- Potential problem: can cause new demand peak at e.g. 20:01

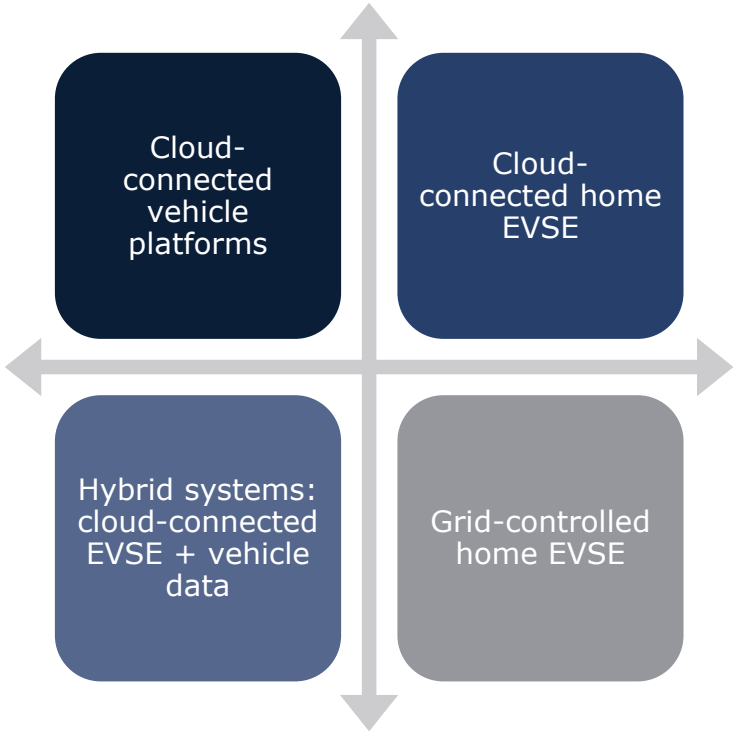




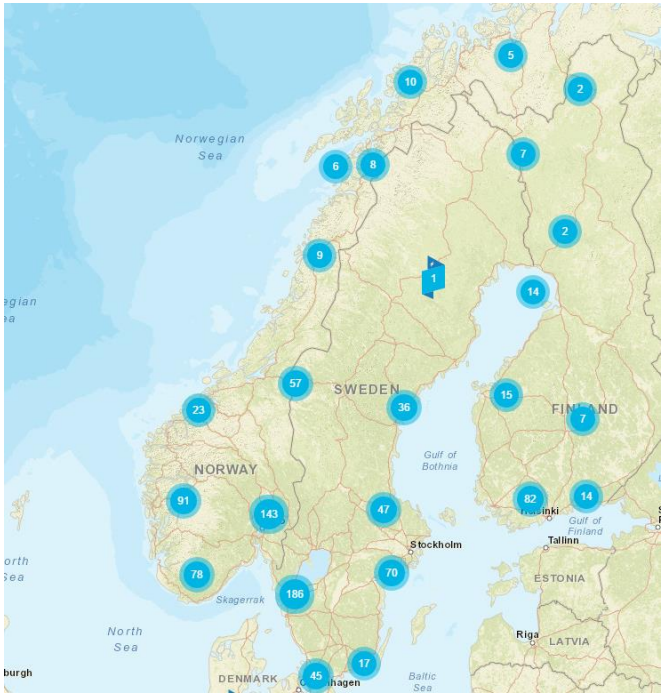


Smart home charging strategy 2: automatic, externally controlled smart charging

- Remotely scheduling and adapting charging of multiple EVs to optimize based on a variety of input parameters
- Possible to provide ancillary grid services
  - Load curve shaping
  - Demand-response (ancillary grid services)
- User benefits
  - Lower charging costs
  - Cut on profits made from ancillary services
  - "Green" conscience by charging with green electricity
- International experience
  - Cloud connected: <10 seconds latency
  - Hard-wired:



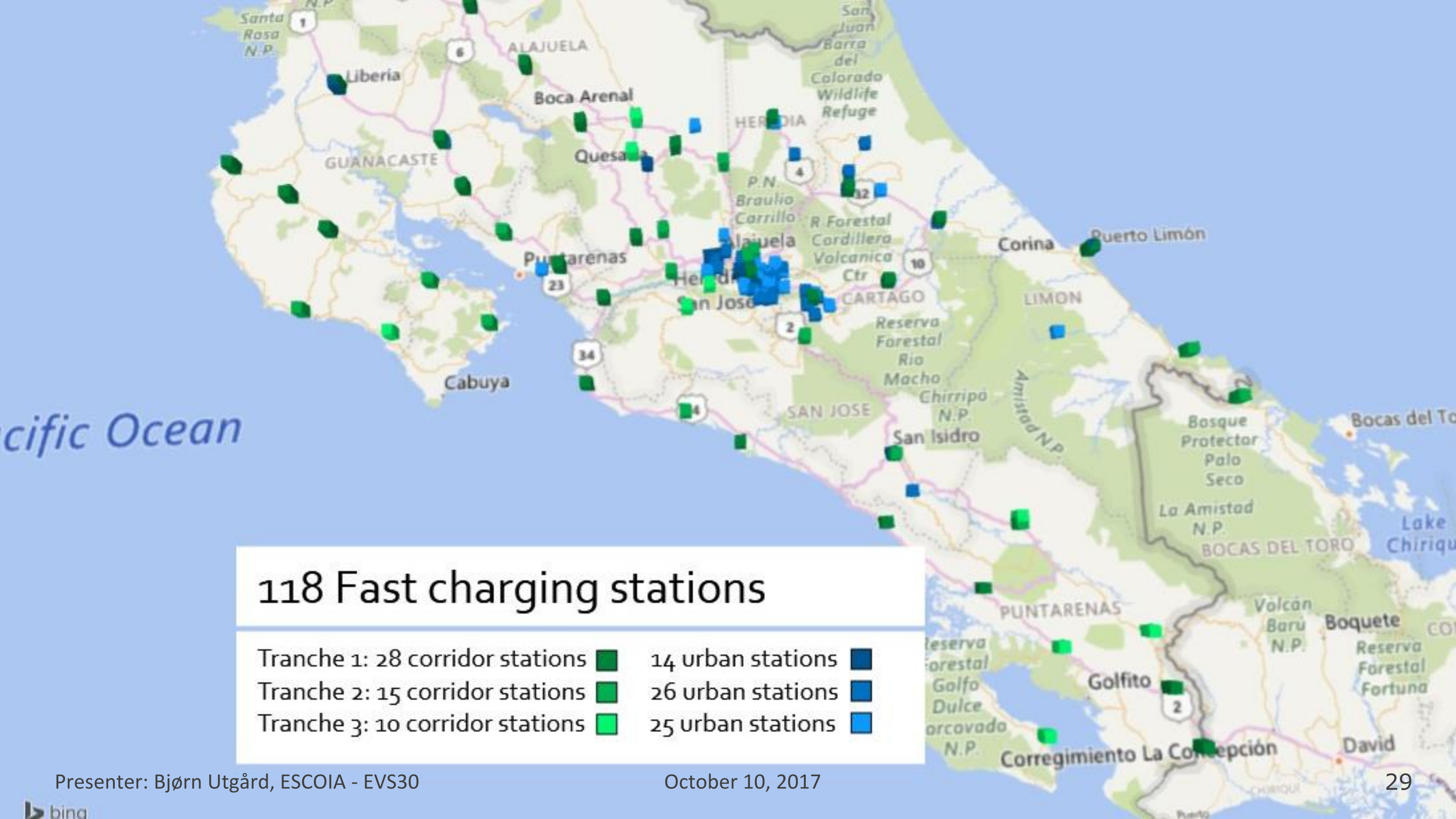
How many fast charging stations are required?
A clue from Norway…



Urban and corridor charging: gauging the number of stations and chargers

Province, municipality	Stations	Chargers
Alajuela	9	18
Cartago	7	14
Guanacaste	3	6
Heredia	6	12
Limón	8	16
Puntarenas	1	2
San José	31	62
Total	**65**	**130**

Rt.	From	To	km	Stat.	Char.
1	San José	La Cruz	260	6	17
2	San José	P. Canoas	351	6	18
4	La Cruz	Guápiles	278	6	14
10	Cartago	Siquirres	86	3	8
21	Liberia	Paquera	172	4	12
27	San José	P. Arenas	95	1	3
32	San José	Limón	155	1	3
34	Cr. 34/27	Palmar N.	203	5	14
35	Florencia	Los Chiles	87	3	8
36	Limón	Sixaola	92	2	4
101	S. Rafael	La Fort.	70	2	5
126	Heredia	San Mig.	60	2	5
141	Naranjo	Florencia	56	1	2
160	S. Cruz	Sámara	96	3	6
162	Sámara	Paquera	150	2	4
237	R. Terba	Corredor	81	2	4
239	C. Colón	Parrita	85	2	5
245	P.Blancas	P.Jimenez	78	2	4
Tot.			2,535	53	136



118 Fast charging stations

Tranche 1: 28 corridor stations	14 urban stations
Tranche 2: 15 corridor stations	26 urban stations
Tranche 3: 10 corridor stations	25 urban stations

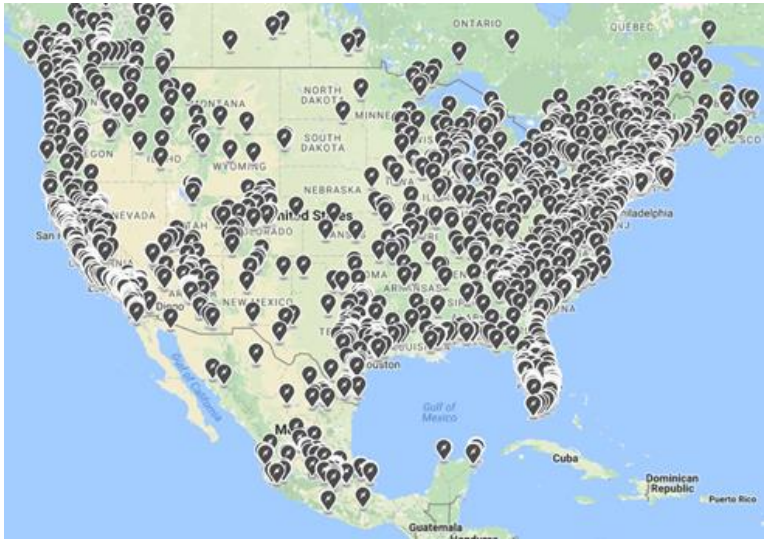
Fast charging investment suggested in tranches. Total investment equals about 30 service stations

Tranche	Corridor stations	Urban stations	Total stations
1	28	14	42
2	15	26	41
3	10	25	35
Total	**53**	**65**	**118**

Type	Stations	Chargers	Investment
Corridor	53	136	$6,800,000
Urban	65	130	$6,500,000
Total	**118**	**266**	**$13,300,000**

Investment will pay for itself through fast charging fees
$7-8 per 20-min charging session → $18-21 million per year

Destination charging: hotels



Electric buses

Electric trucks: save $11,600 per year in fuel + significant maintenance savings

BYD class 8 Electric truck

Mercedes-Benz urban eTruck

Costa Rica – essentially electric

Thank you

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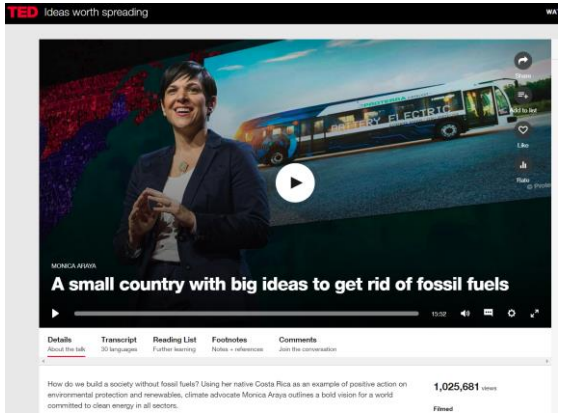

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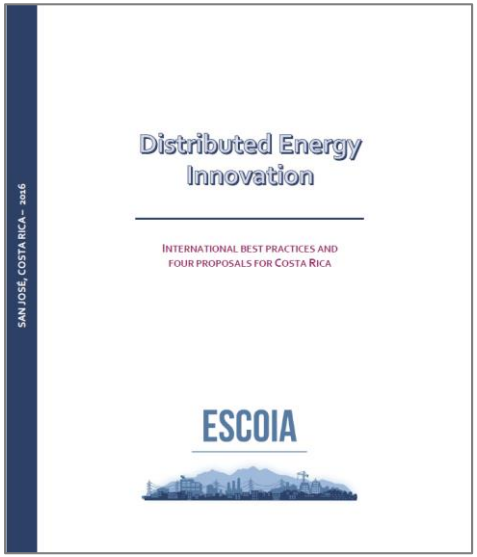

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