DTU students’ posters for the project assignment on ‘Promotion of e-mobility in the public urban transport of Kathmandu, Nepal

DTU course 42583 (Engineering work 2) is a mandatory course of the Bachelor line on Strategic Analysis and System Design. It is given during the 4th semester of this study line and aims at introducing models and theories within system design and engineering. As of next year the course will be renamed into ‘42583 Systems Design.’
The course addresses a complex technological project in the societal context and focuses on transport systems and technologies. Its learning objectives include:

- understand the broad principles of systems thinking and systems engineering, as well as key parts of the process
- understand the role of systems engineering in modern economies
- develop and prepare a problem definition in terms of general requirements and relevant stakeholders
- explain and apply selected methods of Systems Design in the context of systems engineering problems
- explain and apply selected methods of Project Management in the context of systems engineering problems
- explain functions and properties of a system as relating to system requirements/needs
- perform a system design for a chosen problem and apply the basic principles
- explain the complexity and dynamics of a technological system in a wider context
- structure and disseminate information, theories and results about technological systems both in writing and orally

In addition to theoretical lectures, the course involves a course project on which the students work during the semester in groups of 3 to 4. Inspired by DTU’s involvement in the SOLUTIONSplus project, the course instructors, Michael Bruhn Barfod (Associate Professor) and George Panagakos (Senior Researcher), selected the promotion of electric mobility in Kathmandu, Nepal as the topic for the course project in spring 2021.
To obtain the necessary basic e-mobility knowledge, the students were advised to take the WP 2-developed SOLUTIONSplus Course ‘Electric mobility: More than just electrifying cars’, the main material of which was also presented during the 42583 classes. Oliver Lah, the Project Manager of SOLUTIONSplus offered more information on the project, while the Research Fellow of Wuppertal Institute Shritu Shrestha contributed with Kathmandu-specific information. Teaching assistance was offered by the DTU MSc student Caroline Dyrby Andersen.
The title of the project assignment was ‘Promotion of e-mobility in the public urban transport of Kathmandu, Nepal’ and no restrictions on the proposed solutions were imposed. Indicatively it was mentioned that solutions could involve vehicle design (e.g. remodeling of the existing electrical 3-wheelers – ‘safa tempos’), operational features (e.g. recharging methods, innovative business models, etc.) or transport integration services (e.g. Mobility-as-a-Service schemes, sharing arrangements, software applications, etc.). During project work and following suggestions by several groups, the project scope was expanded to include solutions involving private transport modes in an effort to enhance impact.
The students were asked to hand-in:

- a mid-term oral presentation of progress made, where comments were provided by Oliver Lah, Shritu Shrestha and the instruction team,
- a poster presentation during the final class of the course, and
- a group report

To enhance motivation, a poster competition was announced at the beginning of the course. Unless otherwise stated by the relevant students, all posters produced during the course would enter the 42583 Best Poster Competition. The winning team would be offered the opportunity to develop the proposed solution into a BSc thesis during spring 2022. If accepted, the students would be invited to a data collection trip to Kathmandu in the framework of their BSc thesis project (provided that the COVID-19 crisis would allow such activity). Traveling costs would be covered by SOLUTIONSplus.
The selection was to be made right after the poster presentations of 5 May 2021 by a committee consisting of Oliver Lah, Shritu Shrestha, Michael Bruhn Barfod and George Panagakos on the basis of the following criteria (of equal weights):

- Alignment with stakeholder needs
- xExpected impact
- Innovativeness of solution
- Quality of presentation

Among some very good posters, the one of Group 3 was voted as the winner. The students Helene Hjort, Kathrine Sofie Rasmussen, Sascha Thorsgaard Jacobsen and Zofia Lisowska-Petersen, who proposed an innovative business plan over fully electrified public mini-buses, have already accepted the offer to develop their idea into a BSc thesis project in spring 2022.
All 11 posters developed during the course are uploaded here. For more information, please contact Michael Bruhn Barfod (mbba@dtu.dk) and/or George Panagakos (geopan@dtu.dk).

Promotion of E-mobility in the Public Urban Transport of Kathmandu

Meriam Amjed Qassem Al-Shawi, Student, Technical University of Denmark (DTU), Denmark
Magnus Guldberg Skov, Student, Technical University of Denmark (DTU), Denmark
Christopher Hardi Nielsen, Student, Technical University of Denmark (DTU), Denmark

Objective

How can an E-mobility solution be designed and implemented to positively affect the air pollution- and traffic congestion problem in Kathmandu?

Impulse

- Fast-growing population
- Increasing number of registered
- A change is necessary for all parties

Methods used in the project

- SE-process model
- Principle of freedom
- Primarily solution-oriented
- Single-step optimizing search strategy
- Evaluation matrix

Preliminary study

- 3.4 million one-way trips every day
- 913 Operating Tempo's
- 2.036 Micro Bus
- 2.036 Minibus
- Only 33.33% were satisfied with public transport

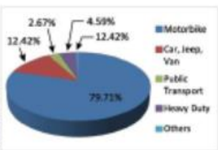


Fig. 2 Composition of registered vehicle fleet in Bagmati Zone

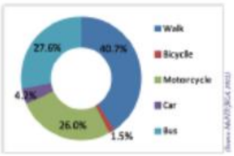
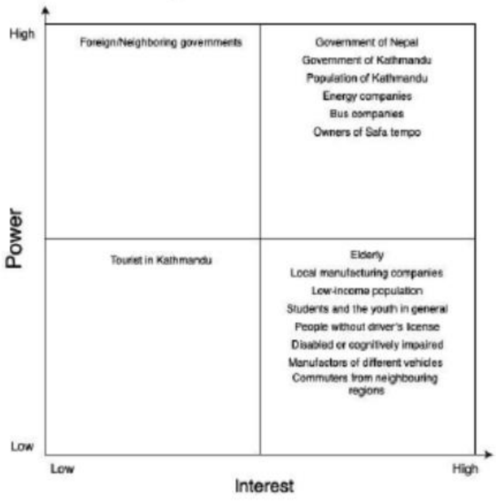


Fig.3 Travel Mode Share of Kathmandu Valley in 2011

Stakeholder analysis

- Found all potential stakeholders
- Defined the stakeholders by their power and interest in an E-mobility solution
- Examined the stakeholder's potential needs



Formulation of objectives

- Used objectives found in preliminary study
- Used principle of freedom to examine objective

Compulsory objectives

- Connecting and integrating the new solution into the existing system without forcing local companies out of the market
- Reduce air pollution
- Decrease traffic congestion
- Affordable implementation cost
- Affordable operating cost

Recommended objectives

- Room for multiple people
- Affordable prices
- Scaling abilities
- Improving mobility for the population
- Accessibility

Desirable objectives

- Reliable transportation

Search for solution

- Group brainstorming
- Five solutions were established
- Next the evaluation phase began

Evaluation phase

- Divided into 3 phases

1. Variance
   - The focus is general solution ideas
   - Assessed the 5 solutions in relation to our objectives

Redesign Safa Tempo	Improve cycling infrastructure	Articulated buses	Traffic congestion pricing	Free to ride e-mobility vehicles
767,09	637,97	656,96	635,44	743,04

2. Variance and 3. Variance
   - Focus for 2. Variance is design
   - Focus for 3. Variance is funding

New 3-wheeler design	Micro Bus
755,70	764,56

Government owned company	Incentives for privately owned	Crowdfunding / Crowdlending
701,27	756,96	749,37

Expected impact and innovativeness

- Safa Tempo will get larger market share
- Solves the problem using a more effective vehicle
- Safa Tempo will over time replace other microbuses and minibuses in the system
- Initiatives for owners of other vehicles to switch to the new solution
- Low degree of innovativeness but highly effective

Conclusion

- Redesign of the Safa Tempo is selected as the optimal solution
- The new Safa Tempo will be designed as a micro bus
- Government funded incentives for privately owned vehicles

For more info:
https://www.urban-pathways.org/uploads/4/8/9/5/48950199/up_kathmandu_project_scoping.pdf
http://www.cen.org.np/uploaded/Public%20Transportation%20in%20KV_Maya%20Factsheet%204.pdf
https://www.sciencedirect.com/science/article/abs/pii/S0301421502002057?casa_token=uPi_vyGGb0MAAAAA:_cwrJA1RS2Vt6mClskXbY-A3rMYpbuB63gTgfu-_XqF9vmm79fLwgw3Mwl.ir5sroO6Wff96Vz6LA

Application to support e-mobility

Anna Olivia deCarle McFall S184307
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Irene Halok S204615

Promotion of e-mobility in the Public Urban Transport of Kathmandu - Nepal

Situation Analysis: PESTLE

P – Political
- Prior government inactivity to sustainability initiatives but increasing interest
- Limitation of government-owned ground
- Planned reduction of 50% on dependency of fossil-fueled vehicles
- Future hydro-powered electrical rail network
- Democracy driven country

E – Economic
- High rate of scooters because of high car pricing compared to general income
- Reduced taxes on e-driven vehicles

S – Social
- Congested roads
- Dense population against road network
- Inadequate public transport system
- Lack of pavement

T – Technology
- >50% smartphone users
- Lack of charging infrastructure for EV's
- Lack of system for used battery disposal
- Future hydro-powered plants

L – Legal
- Ban on three-wheelers

E – Environment
- Possible electricity generation from adequate climate
- Poor health do to polluted air quality

Objective

Compulsory
Reduce air pollution
Promote e-mobility

Recommended
Cheap solution
Possible to upscale
High accessibility

Desirable
Help congestion
safe solution

Stakeholder Analysis

Level of Interest: Low → High; Power: Low → High

	Low interest	High interest
Low power	**A** Minimal effort: Developers	**B** Keep informed: NGO´s, Kathmandu citizens
High power	**C** Keep satisfied	**D** Key players: Investors, National Authorities, Local Authorities

SMART

	Weight	eMaaS s	eMaaS s · w	Charging Station s	Charging Station s · w	Change road network s	Change road network s · w	Public e-cars for rent s	Public e-cars for rent s · w
Reduce air pollution	30	5	150	7	210	2	60	8	240
Promote e-mobility	25	8	200	6	150	6	150	6	150
Cheap	15	8	120	5	75	9	135	4	60
Upscalability	10	9	90	7	70	3	30	10	100
Accessibility	10	8	80	4	40	4	40	9	90
Help congestion	5	4	20	1	5	1	5	1	5
Safe	5	1	5	1	5	3	15	3	15
Sum	100	665		345		435		660	

Public Transport in Kathmandu

Vehicle Type	Fuel	Approx. Length (m)	Passenger capacity incl. standing	Approx. number (existing fleet)	%
Safa Tempo 3 (wheel)	Electric (battery)	5	11	603	4,3%
Gas Tempo	LPG	5	11	430	5,0%
Microbus	Diesel & Petrol	5	14	1.532	11,1%
Microbus (Indonesian)	Diesel & Petrol	3	11	300	2,2%
Minibus	Diesel & Petrol	9-10	Up to 45	2.818	20,3%
Full sized bus	Diesel	12	Up to 100	14	0,1%
E-busses	Electric (battery)	Unknown	Unknown	800	5,8%
Taxi	Petrol	4	Unknown	7.000	50,5%

100%

eMaaS Solution

App • Plan Travel • Public Transport • Route Tracking • e-mobility • Buy Tickets

Impact
Promote e-mobility
Cheap
Upscalability
Accessibility
Easy use of public transport

Challenges
Ticket price of e-mobility
Limited no. of vehicles
Incorporation of taxi services

Implementation plan for electrical minibuses

Project scope

Through the basic principles of systems engineering, which solution should be selected for promoting e-mobility in Kathmandu.

Methodology

- Systems Engineering model
  - SE-model
- Solution demonstration within budget of €50.000

Stakeholder needs

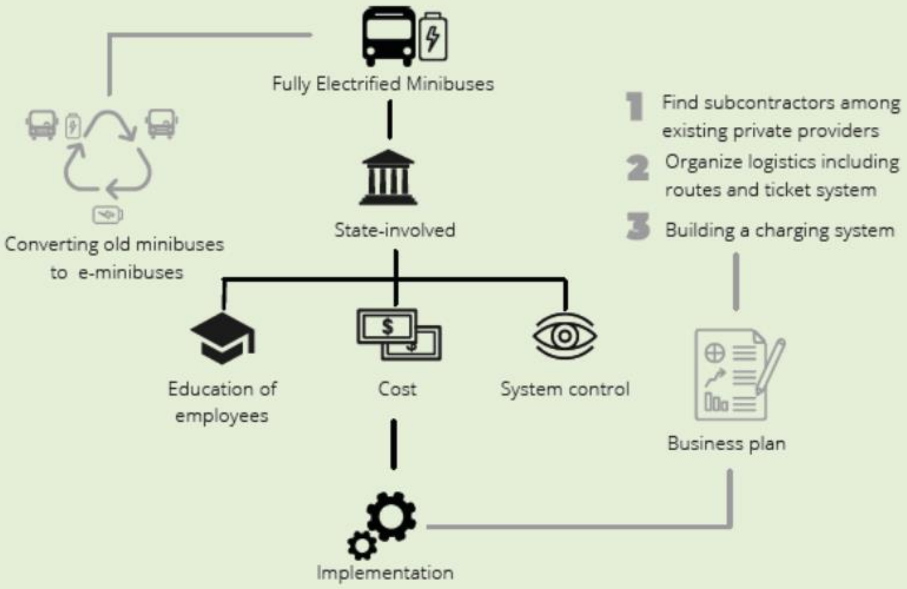
Government/ministries
- Lower CO_2 emission
- Enhance the traffic condition in Kathmandu valley

Citizens in Kathmandu
- Affordable transportation
- Quick transportation
- Safe transportation

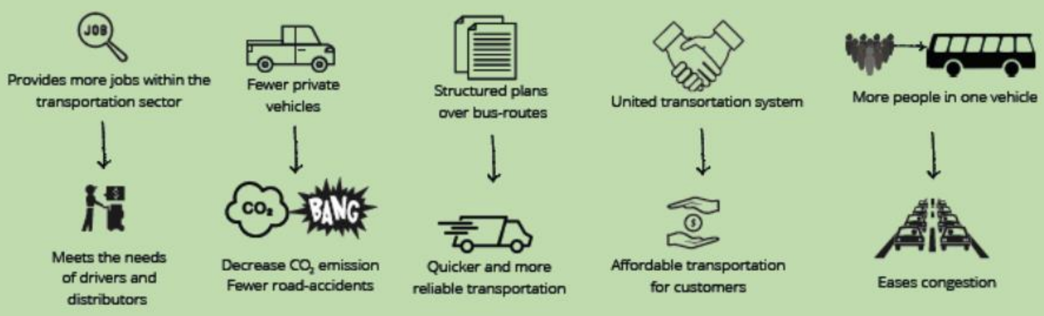
Drivers
- Work opportunities
- Good working conditions including fair pay

Distributors
- Increase sale and revenue

Solution



Impacts



Helene Hjort
Kathrine Sofie Rasmussen
Sascha Thorsgaard Jacobsen
Zofia Lisowska-Petersen

Christian Martin Høg
Marie Adelgaard Lunde
Oscar Lauritz Møberg

Date of presentation: 5/5-2021

The Era of the Two-Wheelers

Objective: Promote e-mobility

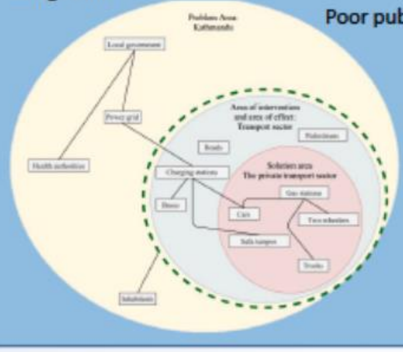
Current situation in Kathmandu:

Air pollution

Safa Tempos and two-wheelers widespread

Congestion

Poor public transportation



Methodology

SE model: principle 3 and 4

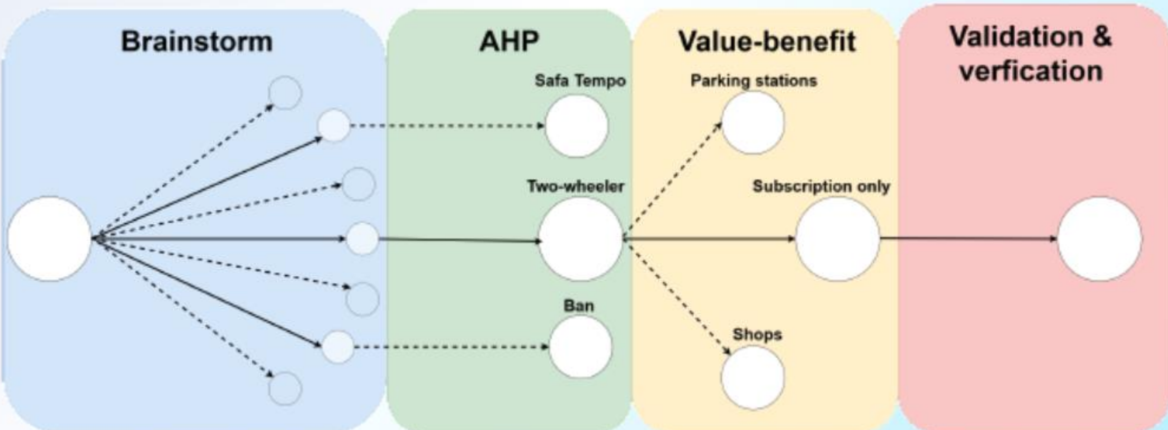
Solution-oriented approach

Criteria

Important

- Air Pollution
- Keep under budget
- Noise Pollution
- Cheap for consumer
- User friendly
- Reduction of congestion
- Socail equality

Less important



Solution details

- Leasing based subscription service
- Customer gets their own 2-wheeler
- Reparis are handled by leaser
- Pays monthly fee for 2-wheeler
- Minimizes upfront cost for Customer

- Has potential for large user base
- Applicable in other cities
- No direct impact on the public transportation

For more info:

Book: Haberfellner Et al.: Systems Engineering

Impact

- Reduced air pollution
- Reduced noise pollution
- Increased awareness of health

Travel Scheduler Uniting Transport in Kathmandu

Carl Debes, Kristoffer Nielsen, Jens Parslov, Johannes Roed

DTU in collaboration with SOLUTIONSplus

The Goal

- Develop solutions, within the domain of e-mobility and public urban transport, that improve the transportation system now, as well as in the future

Methodology

- Plan-driven model was used in the execution of the project.
- Assessment of situation
- Identification of stakeholder needs.
- Systematic search for solutions.
- Value-benefit analysis selected travel scheduler as the optimal solution

Conceptual Design

- The travel scheduler keeps the customers informed. Thus, the customers are better able to plan their trips optimally in advance
- Private operators will have access to a public dashboard and data, which helps them adjust to supply, when planning routes or other activities

Stakeholders and their needs

- A key need and objective is to decrease congestion, which a modality change from private vehicle to public transport will ensure
- An app scheduling the public transport will increase reliability in public transport, which is a need for many stakeholders
- An increase in public transport will also decrease emission of GHG and air pollution
- The travel scheduler is relatively cheap, which aligns well with the needs

Impact

- A travel scheduler was found capable of improving the quality and reliability of public transport at a low cost
- The travel planner will help unite transport in Kathmandu, by providing a tool which boosts intermodality
- Uses existing operators and infrastructure
- Collects valuable data which can help private operators and the public sector, plan for the future

Next Steps

- High level design, what functionality should the travel planner have. Which modes of transport should be supported. Which signals in data is insightful for the private operators.
- Detailed Design, how should data be gathered and stored, such that an optimal path can be found. App design etc.

Acknowledgements:

By Anna Bramsløw,
Lukas Kallestrup Brandt,
Maria Christine Neiiendam
& Nikolai Beck Jensen

Upcycling Scooters to EVs Through Workshops with Upskilled Workers

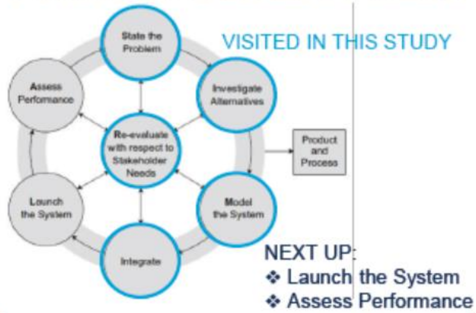
OBJECTIVE

Promoting e-mobility in urban transportation in Kathmandu

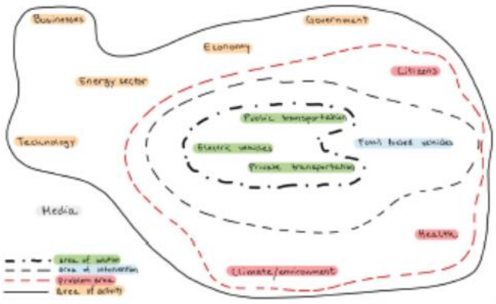
CURRENT SITUATION

- 80% of all registered vehicles are motorbikes
- PM10 levels exceeds WHO guidelines at all times
- NDC target: Increase the share of electric vehicles with up to 20% in 2020 compared to 2010 levels

THE SIMILAR PROCESS IN CONCEPT DEVELOPMENT



AREA OF ACTIVITY



IMPACT

KEY PERFORMANCE INDICATORS	
Waste managed sustainably	[tonnes]
Workforce increase	[# of jobs created]
Unskilled labor	[# of positions filled by unskilled local labor]
Political coordination	min{permits and new policies needed}
Infrastructure	min{€ spend}

KEY PERFORMANCE INDICATORS ESTIMATION

- Waste managed sustainably
- Workforce increase
- Unskilled labor
- Political coordination
- Infrastructure

SOLUTION

- Create educational programs with the focus of upskilling citizens to be able to convert scooters to EVs.
- Set up workshops where the newly educated workforce can utilize their acquired skills.
- Use the new workshops to convert the fleet of scooters in Kathmandu from fossil fuels to electric power.

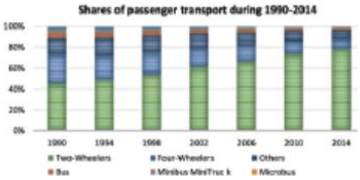
MUST WIN BATTLES

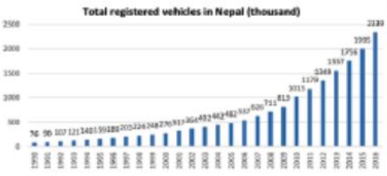
Demonstrate scooter transformation	3 months
3 workshops established	6 months
Educate 9 mechanics	1 year

42583 Engineering Work 2

SMART ENGINE CONVERSION

Do you see the problem?...





Each year more and more vehicles are being imported into Nepal. Of these newly registered vehicles there is a growing amount of two-wheelers each year. As more and more vehicles are being brought to Kathmandu, the pollution levels are reaching critical highs. In 2016, the annual average exposure of PM 2.5 in Kathmandu Valley was nearly five times higher than the WHO standard. Furthermore, the Greenhouse gas emissions are foreseen to continue growing within the next decade at a rapid pace according to the Nepal Second National Communication. The table below illustrates the dire predictions of the coming emissions from the transport sector alone.

Description	Projected GHG emission by year (CO_2 equivalent Gg)						
	2000	2005	2010	2015	2020	2025	2030
BAU Scenario:	951.33	1108.55	1384.49	1736.14	2177.04	2729.91	3423.17
CO_2	939.70	1095.00	1367.57	1714.93	2150.43	2696.54	3381.34
CH_4	2.11	2.46	3.07	3.85	4.83	6.05	7.59
N_2O	9.52	11.09	13.85	17.37	21.78	27.31	34.25

As it doesn't seem like there will be a change in the transport habits of the motorists within Kathmandu, the logical choice is to look at the reduction of noxious emissions from the two-wheel segment.

Objectives

The Smart Engine Conversion(SEC) looks at solving the pollution problem from a multitude of angles. Therefore, the following objectives have been set as solution targets.

- The solution must secures & later grow current governmental revenue.
- Charging must be available without specific infrastructure investment.
- The SEC costs must be half or less of a new EV two-wheeler of similar type.
- The SEC must have a range of at least 48 km.
- The SEC performance must have a maximum speed of at least 50 km/h.
- The SEC must be 100% electric and 100% emission free.
- The Design must be flexible and scalable to suit a variety of motorist needs.

*Initial prototype costs are estimated to run at 50.000€.

"DON'T RECYCLE RE-USE!"

Impact

Average daily VKT	20
No. Start pr. day	3,80
New MC cost	10000 $
Conversion kit	3000 $

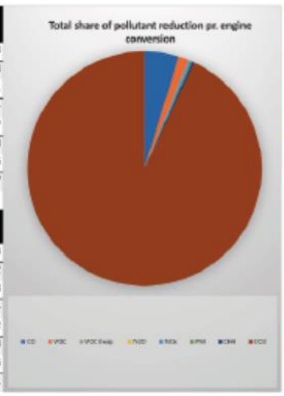
The average number of kilometres travelled in central Kathmandu is 20 km. An average of 3.8 engine starts are initiated pr. MC motorist everyday.

	Lower	Mean	Upper	Lower	Mean	Upper	Lower	Mean	Upper	Lower	Mean	Upper
Stats		CO			VOC			VOC Evap.			N_2O	
Run, g/km	2,41	4,68	6,76	0,73	1,46	2,2	0,15	0,28	0,41		-	
Start, g/start	3,89	9,65	13,71	2	3,1	3,3	0,1	0,19	0,28		-	
Pollution from average daily VKT	48,2	93,6	135	14,6	29,2	44	3	5,6	8,2		-	
Pollution from average daily engine starts	14,542	36,67	38,798	7,6	7,98	8,36	0,38	0,722	1,064		-	
Total pollution pr. vehicle*	62,742	128,27	173,798	22	37,18	52,36	3,38	6,322	9,264		-	
Stats		NOx			PM			CO_2			CH_4	
Run, g/km	0,16	0,29	0,42	0,05	0,1	0,15	60,53	124,91	185,29	0,15	0,3	0,45
Start, g/start	0,59	0,62	0,65	0,09	0,1	0,09	4,32	4,7	5,08	0,41	0,43	0,45
Pollution from average daily VKT	3,2	5,8	8,4	1	2	3	1210,6	2498,2	3705,8	3	6	9
Pollution from average daily engine starts	2,242	2,356	2,47	0,342	0,38	0,342	16,416	17,86	19,304	1,558	1,654	1,71
Total pollution pr. vehicle*	5,442	8,156	10,87	1,342	2,38	3,342	1227,016	2516,06	3805,104	4,558	7,654	10,71

A number of motorcycles has been GPS tracked and their emissions levels recorded within inner Kathmandu. The above table shows the lower and upper bound as well as the average level of emission from the motorcycles within inner Kathmandu. The average daily kilometres driven was found to be 20 kilometres. And the average number of starts pr. day was recorded at 3.8. The yellow lines display the impact of each engine conversion given the average number daily number of kilometres driven as well as the average number engine starts.

AVG daily reduction of pollutants in g pr. dollar spent	
CO	0,0428
VOC	0,0124
VOC Evap.	0,0021
N2O	-
NOx	0,0027
PM	0,0008
CH4	0,0025
CO2	0,8387

AVG. daily reduction of pollutants in g pr. engine conversion	
CO	128,3
VOC	37,2
VOC Evap.	6,3
N2O	-
NOx	8,2
PM	2,4
CH4	7,6
CO2	2516,1



At an average dollar cost of 3.000 USD pr. SEC, the benefit on average from each dollar funded into the project can be estimated. As can be seen from the above model the SEC has the largest impact on CO_2 reduction.

With around 355.000 two-wheelers in Kathmandu valley (and increasing), the impact potential is extremely large. As of now the number of estimated SEC vehicles is still too early to forecast.

**The above numbers are estimates and may vary depending on SEC model as well as individual mechanic costs and shipping rates. Calculations shown are in USD for ease of reader interpretation. Costs may vary in different currencies.

Solution

Key Activities

The key activity revolves around engine conversion, turning fossil fuelled motorcycles and scooters into electric vehicles.

In addition a maintenance structure is to be set in place for the purpose of user service and vehicle maintenance.

Value Propositions

The solution gives motorists in the private sector a cheaper alternative to obtain an electric two-wheeler. It also allows for the public sector to save money by not having to buy new EV's for their entire fleets.

Maintenance and support will be in place in order to give the user greater confidence in the conversion system as well as more reliable products. Maintenance is also done on fully electric vehicles, allowing users to transition into newer EV's in the future.

The solution allows for EV's that do not require charging stations, but can be charged through wall sockets or in the case of scooters a removable battery.

Gives user savings through lower fuel consumptions as electricity is cheaper.

Segments

There are two user segments the solution could initially target. Both segments are set within the boundary of Kathmandu:

1. **Private market of motorists**

The aim is to have motorists bring their MC/Scooter to a conversion workshop and have a retro fitted engine installed, rather than buying another fossil fuelled bike. This is both cheaper for the motorist and better for the environment. On top of that, the engine conversion allows for more job creation rather than importing new bikes.

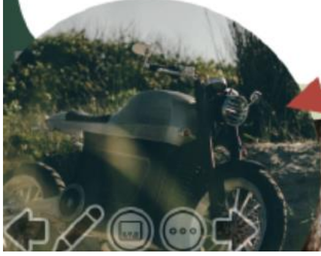
2. **Kathmandu public sector**

Public institutions using MC's can have their fleet of vehicles converted to EV's. This saves the public sector money and allows the institutions to use the vehicles without investing in expensive charging infrastructure.

Relationships

A strong relationship with the users is essential. Therefore emphasis on careering for the users needs is a high priority in order to build confidence in EV's and thus promote EV's to the broader public.

Especially conversion done on public sector vehicles need a strong maintenance and support system to push for a more sustainable future.



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MELT IT. SHAPE IT. REUSE IT

Objectives

Produce a solution that promotes e-mobility in Kathmandu

- Increase number of daily EV trips
- Make e-mobility more accessible
- Positively influence the public's perception of e-mobility

Methodology

Adopt the impulse of the basic SE model

1. Situation Analysis
2. Formulation of Objectives
3. Synthesis of Solution
4. Analysis of Solution
5. Evaluation
6. Decision

Stakeholders

Minimal Effort
- Small businesses of Kathmandu

Keep Informed
- Other cities of Nepal- and other countries facing similar challenges
- Organizations working to compile and implement ideas

Keep Satisfied
- The industry and business sector of Nepal
- Foreign energy- and technology companies

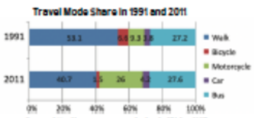
Key Players
- Government of Nepal
- People of Kathmandu / Nepal

Boundaries

- Stay within the demonstration budget (~50 000€)

Deeper Analysis

- 3.4 millions one-way trips made each day
- When lithium batteries comes to an end – retains about 80% of its charge
- About 24.000 tons of batteries are discarded in Nepal each year



Source: http://www.cen.org.np/uploaded/Urban%20 Mobility%20Kom%20MaYA%20Factsheet%201.pdf

Allignment with Stakeholder Needs

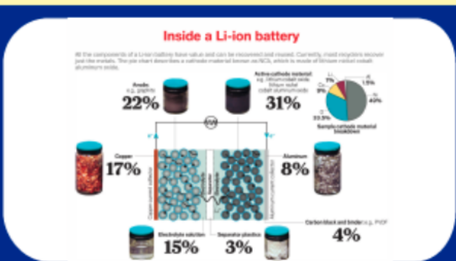
- Recycling of the batteries is well-documented to lower both expenses and CO_2-emission
- The Government of Nepal would have a hard time not wanting a lower expenses and CO_2-emission
- Recycling lithium batteries will benefit the EV owners
- Recycled batteries are cheaper and produces less CO_2

Expected Impact

Objective	Battery Recycling
FINANCIAL OBJECTIVES	
Low cost	High investment, but potential for big future savings ✓
Budget	Possible to demonstrate cheap battery recycling ✓
FUNCTIONAL OBJECTIVES	
EV trips increase	Yes ✓
SOCIAL OBJECTIVES	
Avoid limitations	Yes ✓

Objective	Battery Recycling
FUNCTIONAL OBJECTIVES	
EV-share increase	Pathway to more EVs ✓
GHG-vehicle-share decrease	Indirectly, but yes ✓
Accessibility	Yes ✓
SOCIAL OBJECTIVES	
Influence perception	Yes ✓
Air- and noise pollution	Indirectly, but yes ✓

RECYCLE LITHIUM BATTERY



Source: https://cen.acs.org/materials/energy-storage/time-serious-recycling-lithium/97/i28

Establish a systematic recycling infrastructure, where the government is to make recycling stations where the public can deliver their used batteries and have them recycled

- A recycling facility would both make the accessibility of batteries better → "greener" batteries
- Benefits of recycling batteries:
  - Salvaging valuable rare earth metals
  - Batteries not thrown in landfills
  - Savings on material costs
- Discount on new batteries as an incentive
- Less import of batteries → more recycle of batteries within Kathmandu

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For more information:
http://www.solutionsplus.eu/
The Project Assignment Rapport

One App
One Solution

Main objective: Promote E-mobility in Kathmandu

- Reduce air-pollution
- Ensure availability
- Reduce traffic jams
- Better traffic reliability
- Ensure better business-condition for new e-vehicles companies entering the marked
- Create a sustainable traffic-system

Key Performance Indicators

Traffic Jams	Average time in jams
Air Quality	AQI
Customer satisfaction	Survey
Number of entering E-companies	Statistics
Increase in travels made with public transport	Percent travelling with public transport

App functions

How GoFlow is attractive to customers

- Effective travel
- Travel-planner
- Easy payment
- Travel-guarantee
- Active users can gather points to buy goods and receive gifts

How GoFlow is attractive to suppliers

- Goods for E-transport
- Profit-loss over time, when customers don't buy tickets not provided by app
- It is the new marked

How GoFlow promote E-transportation

E-transport	Fossile-transport
• 2% of profit to app • No registration-fee • Advertisement on busses is allowed • Recommended suggestion on travel-planner • 10% cheaper tickets (government subsidised)	• 4% of profit to app • Registration-fee • Advertisement on busses is not allowed • Always second suggestion on travel-planner • Normal prize-tickets