Benefit analysis of the utilization of electric cars on the example of ProCredit bank Serbia's car fleet

Milena Milosavljević
Danko Kalkan

Environmental Management Unit, ProCredit bank, Serbia

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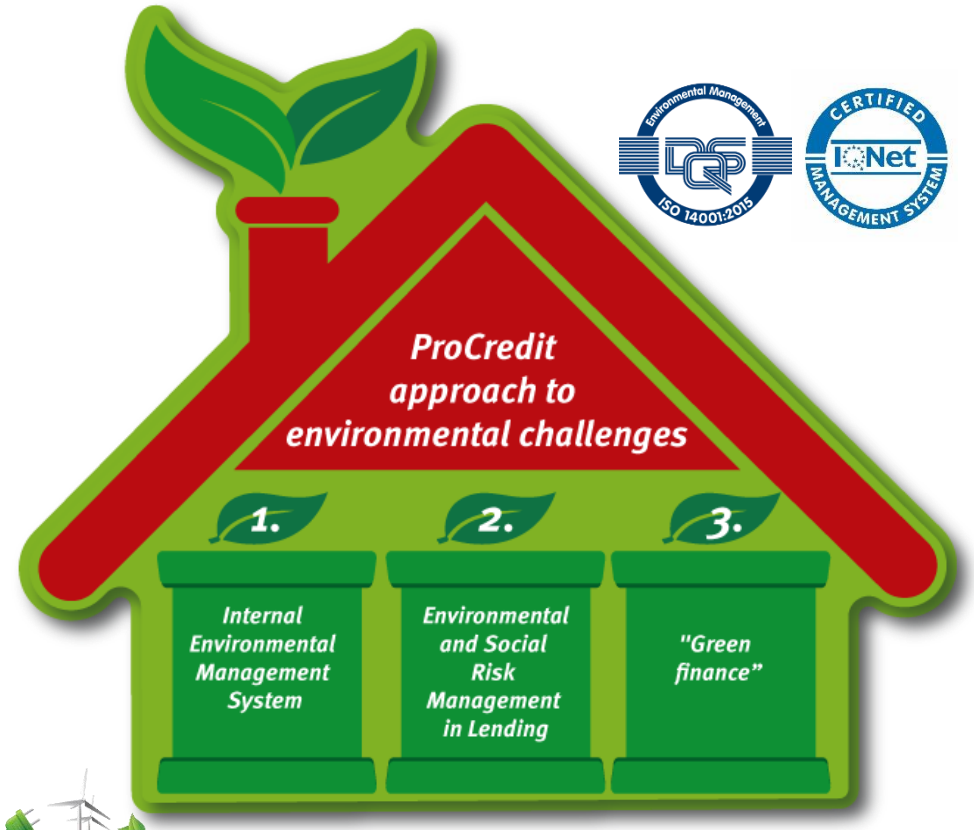
Introduction

- Climate change imposes challenges to the sustainable development
- Paris Agreement's goal is to keep the global warming well below 2°C compared with the pre-industrial period
- It is necessary to take multiple adaptation and mitigation measures to fulfill the goal
- Transport is one of the main contributors to the GHG emissions and its impact on climate change and human health is tremendous
- According to the World Health Organisation, around 100,000 premature deaths in Europe are connected to air pollution
- Alternative s ation s
- Use of Electr possibl
- The presenta e use o entional Diesel Vehicle (DV) f the c bia

Environmental Management System at ProCredit bank Serbia



- Internal EMS:
  - Collection of data on consumption of energy and resources;
  - Annual Environmental Plan of measures with aim to decrease of the negative impact;
  - Awareness raising among staff;
  - Green suppliers of the bank.

Transport is significant contributor to the bank's impact on the environment.

Car fleet overview

- Overview of the car fleet and share of low-emission vehicles

Car make and model	*Number*
Škoda Superb	3
Škoda Octavia	*6*
ŠkodaFabia 1.6 TDI	*10*
Ford Fiesta 1.6 TDCi	*21*
Toyota Prius 1.8 Hybrid	*6*
Volkswagen E-UP	*7*
TOTAL	*53*
Share of EV and HEV in the total fleet	***24.5%***

DV Ford Fiesta Econetic 1.6 TDCi:

- Engine power: 66 kW
- Consumption per specification: 3.3 l/100km
- Carbon-dioxide emissions per specification: 87 g/km

EV Volkswagen E-UP:

- Engine power: 60 kW
- Battery capacity: 18.7 kWh
- Charging time: 5h
- Maximum distance: 160 km
- Energy consumption per specification: 11.7 kWh/100km

EV charger with SPP

- The bank installed the charger and SPP in front of its Head Office in Belgrade in 2017
- Total installed power of SPP is 4.5 kW
- 18 polycrystalline solar panels, each 250 W
- Inverter: Fronius Primo (5 kW)
- Installed charger: Schneider EV link Smart Wallbox 22 kW
- Projected annual energy production of SPP 3,607 kWh

Comparative analysis of CO_2eq emissions

- Two vehicles are compared based on the real mileage in March 2018 in urban conditions (both vehicles covered ca. 300 km)
- *Example 1: EV charging on non-solar energy network*

Parameters (March 2018)	Electric vehicle E-UP	Ford Fiesta Econetic 1.6 TDCi
a) Actual monthly consumption	16.46 kWh/100 km	5.63 l/100 km * 10,033 kWh/l = 56.48 kWh/100 km
b) Emission factor	0.711 kgCO_2eq/kWh	0.267 kgCO_2eq/kWh
Emission per 100 km a) x b)	**11.7 kgCO_2eq**	**15.1 kgCO_2eq**

- CO2eq emission referring to EVs charged on the network from the energy mix in urban driving conditions is lower by **22.51%** compared to the DV's equivalent CO2 emission
- When driving on the open road DV consumes 4.5 l/100km, therefore savings in GHG emissions are **reduced to only 3%** compared with EV's indirect emissions

Comparative analysis of CO_2eq emissions

- Two vehicles are compared based on the real mileage in March 2018 in urban conditions (both vehicles covered ca. 300 km)
- *Example 2: EV charging via the SPP*
- SPP produced 125 kWh in March 2018

Parameters (March 2018)	Electric vehicle E-UP	Ford Fiesta Econetic 1.6 TDCi
a) Actual monthly consumption	16.46 kWh/100 km	5.63 l/100 km * 10,033 kWh/l = 56.48 kWh/100 km
b) Emission factor	0 $kgCO_2eq/kWh$	0.267 $kgCO_2eq/kWh$
Emission per 100 km a) x b)	**0 $kgCO_2eq$**	**15.1 $kgCO_2eq$**

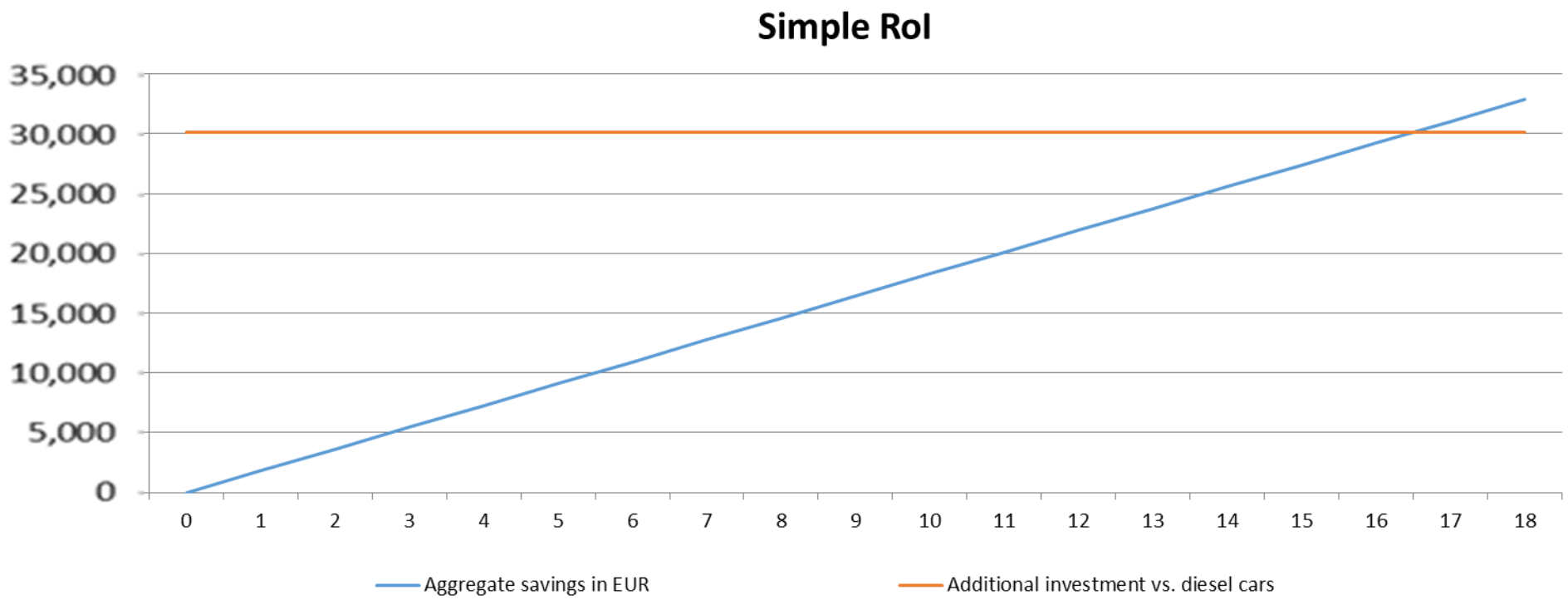
- CO2eq emission savings – 100%
- Projected annual production from SPP: 3,607 kWh - enough to cover distance of 21,728 km

Cost-effectiveness analysis

Parameters	Volkswagen E-UP	Ford Fiesta Econetic 1.6 TDCi
Investment value of new vehicles	EUR 29,000 + EUR 14,000 for charger and SPP = EUR 43,000	EUR 12,900
Fuel costs	EUR 0/kWh	EUR/l 1.37
Registration costs	RSD 18,000	RSD 22,000
GPS costs	RSD 12,240	RSD 12,240
Washing costs	RSD 6,000	RSD 6,000
Tyre replacement costs	RSD 4,000	RSD 4,000
Service – battery check, filter replacement, cab air, pollen filter	RSD 6,000	RSD 30,000
Other costs – solar charger	RSD 12,000	RSD 2,000
Total maintenance costs	RSD 58,240 (EUR 500)	RSD 76,240 (EUR 650)
Maintenance savings	EUR 650 - EUR 500 = **EUR 150**	
Fuel consumption for 21,728 km	3,607 kWh * 0 EUR/kWh= **0 EUR**	1,223 l * EUR/l 1.37 = **EUR 1,675**
TOTAL SAVINGS (fuel and maintenance)	EUR 1,675 + EUR 150 = **EUR 1,825**	

Cost-effectiveness analysis

- $Simple\ RoI = \frac{\text{difference in investment}}{savings/p.a.} = \frac{EUR\ (29{,}000+14{,}000)-EUR(12{,}900)}{EUR1{,}675+150} = \frac{EUR\ 30{,}100}{EUR\ 1{,}825} = \mathbf{16.5\ years}$



Conclusions

- Savings in GHG emissions of the observed EV in urban driving compared to DVs amount to **22.51%** while for open road driving of DVs (lower consumption), calculated savings amount to **3%.**
- However, if we take into account future changes of Serbia's energy share, savings effects regarding the use of EVs would be significantly higher.
- On the other hand, driving this particular EV, which is charged via solar panel chargers **allows 100% savings in emissions,** which has a positive impact on pollution reduction, especially in urban areas.
- Installed SPP's annually projected output allows "clean" transportation for **21.728 km.**
- Return on investment, based on the current conditions, is relatively unfavorable – **16.5 years**
- Set of measures on macro level, such as import reliefs, purchase subsidies, cost-free registration, free parking and possibility to use so called yellow lane in the cities, needs to be imposed in order to intensify demand for EV.

Thank you for your attention!

Danko Kalkan

Environmental Co-ordinator

d.kalkan@procreditbank.rs

063/387-189

Milena Milosavljević

Environmental Specialist

m.milosavljevic@procreditbank.rs

065/61-62-249