ELEKTRİKLİ ARAÇ KONSEPTİ, AVANTAJLARI VE ARAŞTIRMA ALANLARI

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OTOMOTİV MÜHENDİSLİĞİ ÖĞRETİM ÜYESİ

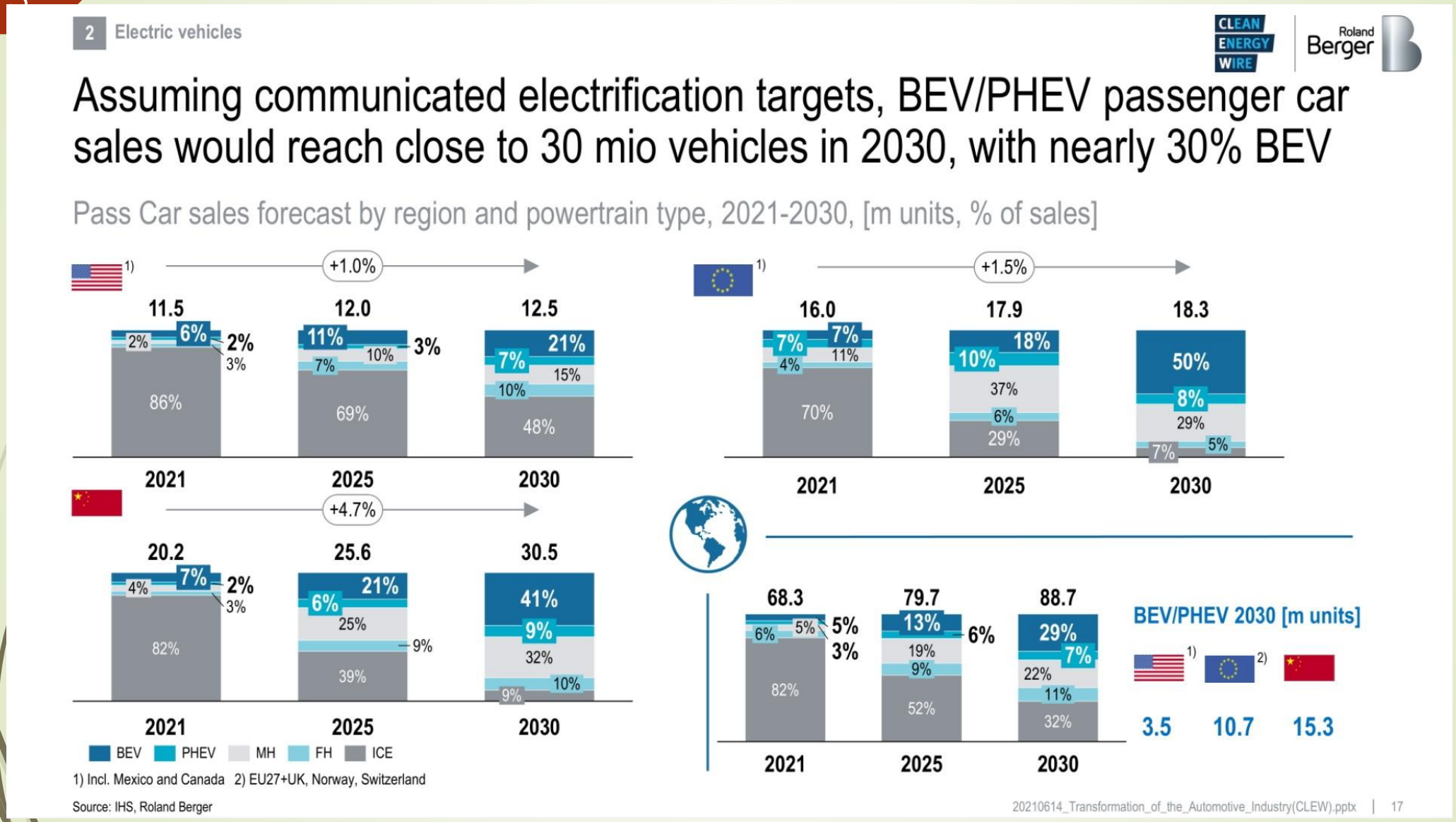
NEDEN ELEKTRİKLİ ARAÇ?

#Drive systems #Electrification #Electric vehicles

The electric drive

efficient, dynamic, and with zero local CO_2 emissions

Gelecek Nasıl Şekillenecek ?



Gelecek Nasıl Şekillenecek ?

In 2030, around **3 million** newly registered passenger cars and light commercial vehicles will be powered by fuel cells.

Fuel cell

Long-distance electric transport for deliveries into urban areas

Diesel has a **15 %** CO_2 advantage over comparable gasoline systems.

At least **67 %** of all new vehicles will still be powered by a diesel or gasoline powertrain in 2030, with or without hybrid technology.

Vehicles with ICEs

More economical and eco-friendly in regular long-distance operation

In 2030, around **35 %** of all newly registered passenger cars and light commercial vehicles will feature fully electric drive systems.

Battery

The home of the electric car is the city

Electric motors with efficiency of up to **98 %** enable efficient and dynamic driving.

By 2030, almost **50 %** of the passenger cars and light commercial vehicles with internal-combustion engines will feature partially electric drive systems.

Hybrid

Efficient and dynamic thanks to electrification

Consumption up to **15 %** lower with the 48-volt system.

Renewable synthetic fuels

Important component of the future mobility mix

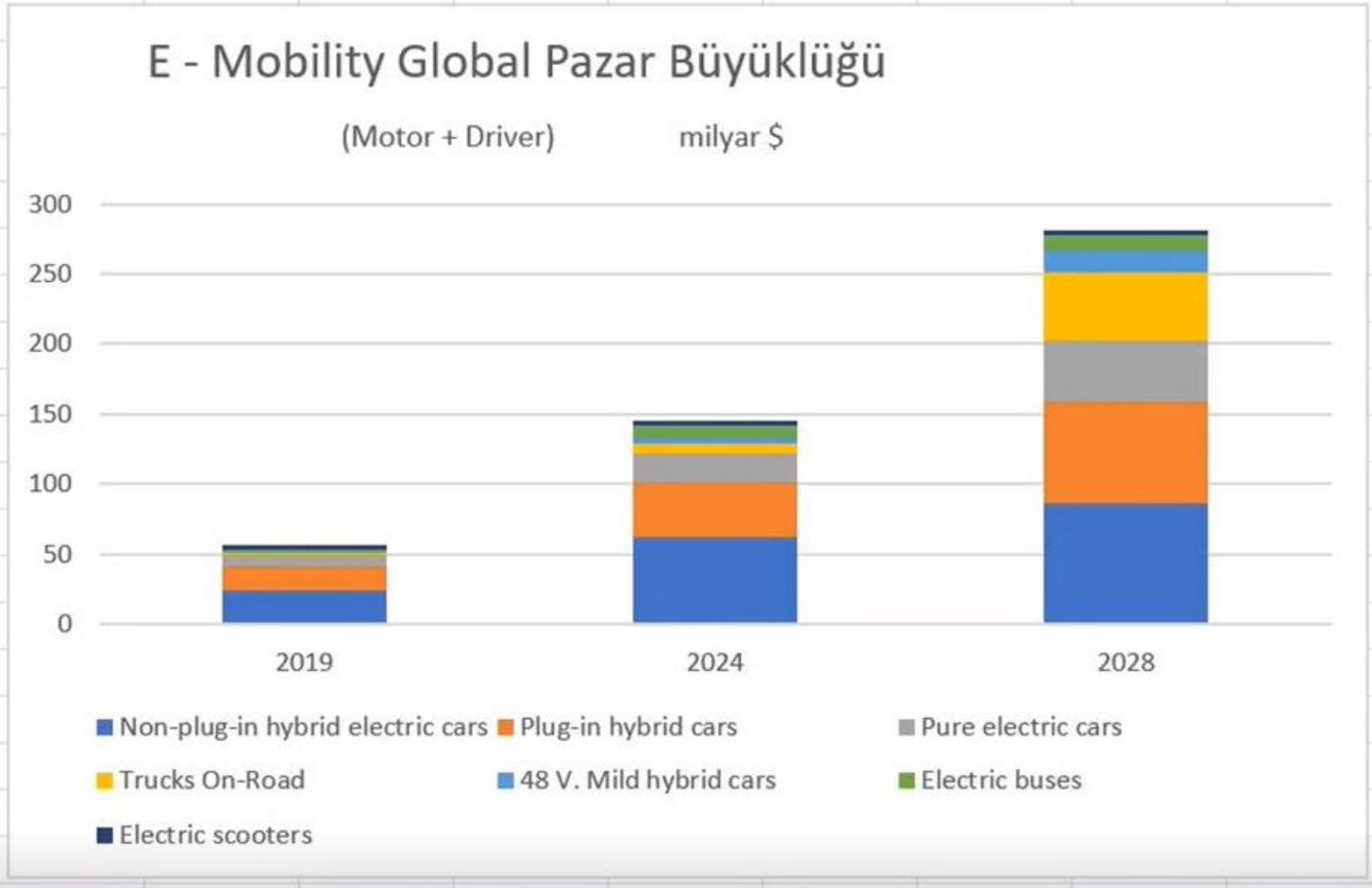
Around **50 %** of the vehicles that will be on the road in 2030 have already been sold – most of them with gasoline or diesel engines.

100 % of all vehicle with ICEs could be run carbon-neutrally with renewable synthetic fuels.

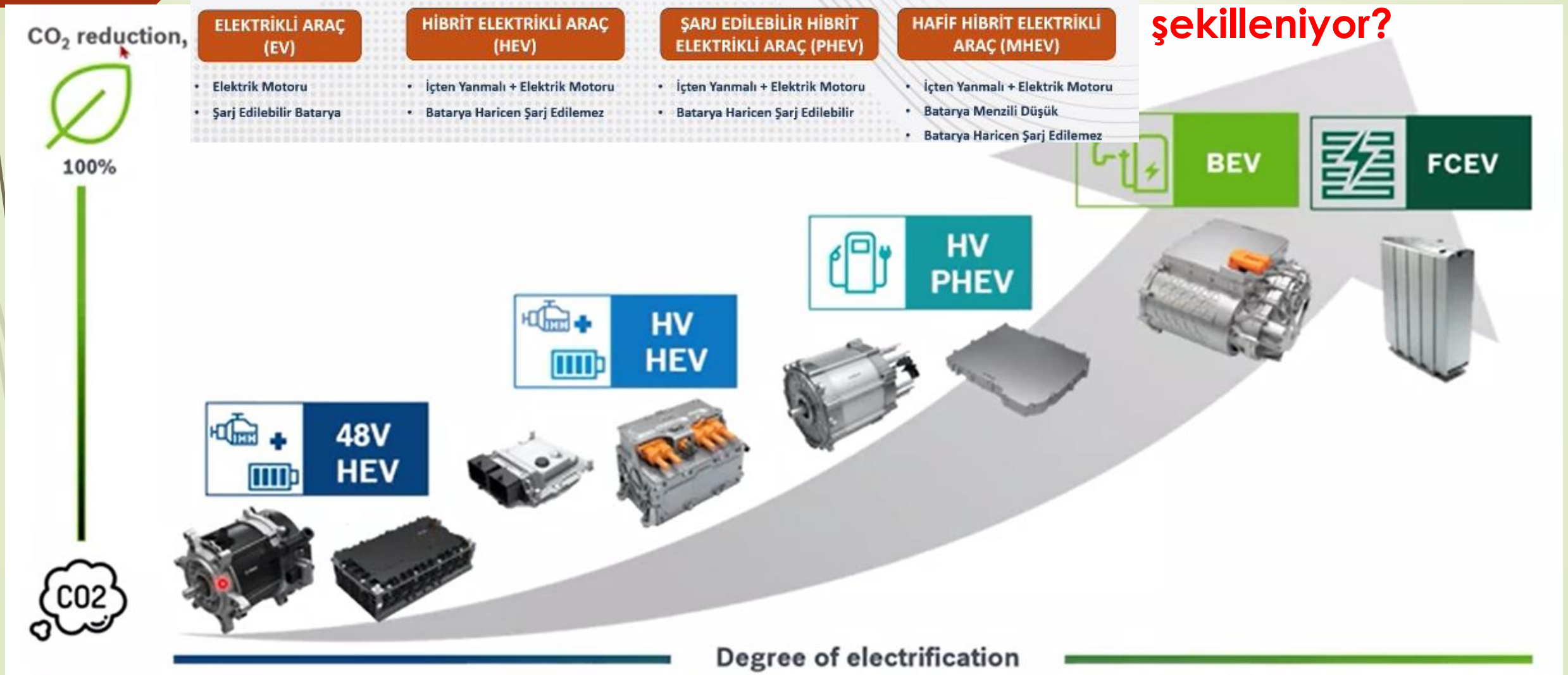
Gelecek Nasıl Şekillenecek ?

Elektrikli Araç Sektöründe Trendler ve Hedefler

	2019	2024	2028
Non-plug-in hybrid electric cars	25	63	87
Plug-in hybrid cars	17	39	72
Pure electric cars	8	20	44
Trucks On-Road	0,6	7,1	48
48 V. Mild hybrid cars	0,4	5	16,5
Electric buses	2,6	8	10,5
Electric scooters	2,6	3,2	3,6
Toplam	56,2	145,3	281,6
Electric motorbikes	0	0,2	0,6
Electric forklifts	0,5	0,5	0,5
Battery electric Lawn mower	0,1	0,3	0,5
Battery electric Disabled mobility	0,4	0,4	0,5
Battery electric Golf car	0,5	0,4	0,4
Consumer and prosumer drones	0,2	0,2	0,2
Manned multicopters and derivat	0	0	0,2
Toy drones	0	0	0
Genel Toplam	57,9	147,3	284,5



Elektrikli araçlara geçiş nasıl şekilleniyor?



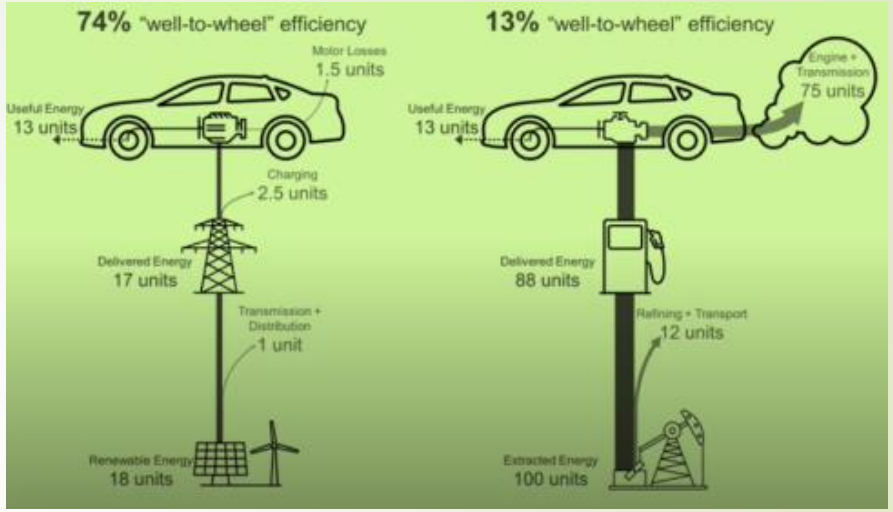
Neden Elektrikli Araç ?

Avantajlar

- Elektrik enerjisi yenilenebilir enerji kaynakları ile üretilebilir.
- Enerji üretiminden tüketimine kadar daha az emisyon salınır.
- Daha ucuz ve az sıklıkta bakım imkanı vardır.
- İçten yanmalı motorlara göre daha sessiz çalışırlar.

Dezavantajlar

- Batarya kapasitesine bağlı olarak düşük menzil
- Bataryaların şarj & deşarj ömrünün kısa olması
- Batarya maliyetinin yüksek olması
- Şarj istasyonlarının yaygın olmaması
- Batarya şarj süresi



Katalog Değerleri					Kullanım Değeri	İstasyon ve Ev tarifelerine Göre Şarj Dolum Ücretleri						Kullanıma Göre Tüketim Değerleri	
Otomobil	Güç (HP)	Tork (Nm)	Batarya Kapasitesi (net kWh)	Şarj Hızı (km/h)	Tam Şarj ile Gidilen (km)	Evde şarj ücreti (<240 kWh)	Evde şarj ücreti (>240 kWh)	ZES (AC)	ZES (DC)	eŞarj (AC)	eŞarj (DC)	Ortalama Tüketim (kWh/100km)	Ortalama Tüketim (km/kWh)
iX	610	1100	105,2	650	608	₺183,05	₺273,52	₺820,56	₺1.030,96	₺683,80	₺862,64	17,5	5,7
					₺/km	₺0,30	₺0,45	₺1,35	₺1,70	₺1,12	₺1,42		

Katalog Değerleri						Kıyasla M8 Yakıt Dolumu Ücret Farkı						Kataloğa Göre Tüketim Değerleri	
Otomobil	Güç (HP)	Tork (Nm)	Yakıt Depo Hacmi (Litre)	Yakıt Dolum Ücreti (₺)	Tam Depo ile Gidilen Mesafe (km)	Evde şarj ücreti farkı (<240 kWh)	Evde şarj ücreti farkı (>240 kWh)	ZES (AC) farkı	ZES (DC) farkı	eŞarj (AC) farkı	eŞarj (DC) farkı	Yakıt tüketimi (litre/100km)	₺/km
M8 Competition	617	750	68	₺ 1.185,24	630	₺1.002,19	₺911,72	₺364,68	₺154,28	₺501,44	₺322,60	10,8	₺ 1,88
					₺/km farkı	₺1,58	₺1,43	₺0,53	₺0,19	₺0,76	₺0,46		

BEV

Performance of EV's;

- acceleration time,
- maximum speed,
- gradeability....

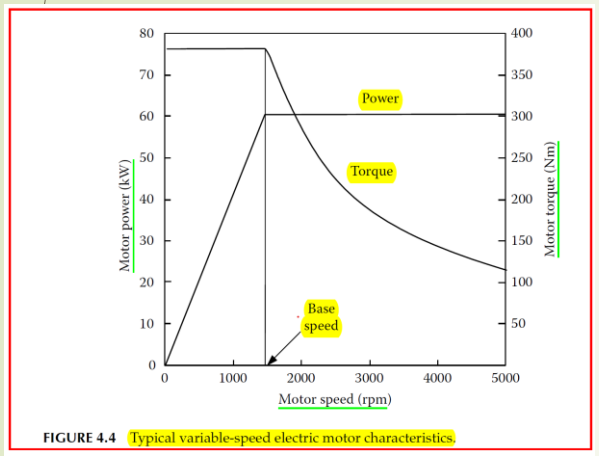
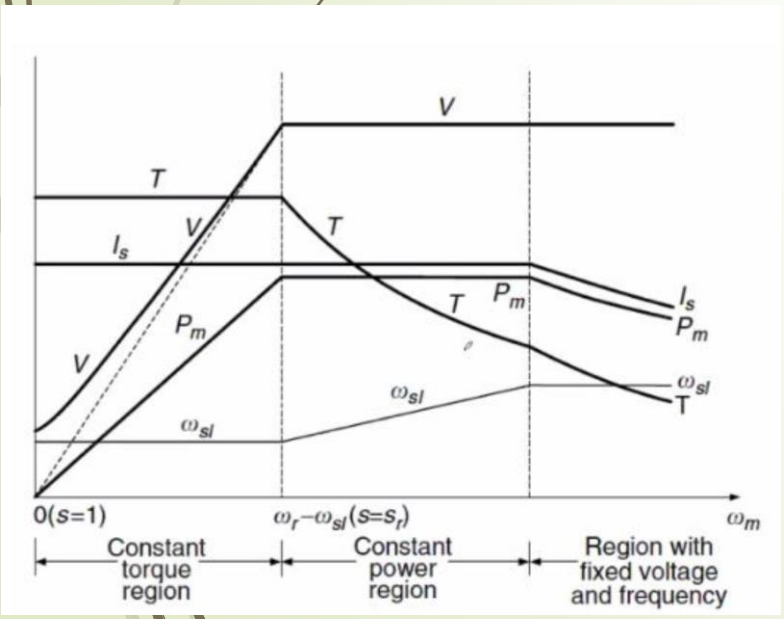


FIGURE 4.4 Typical variable-speed electric motor characteristics.



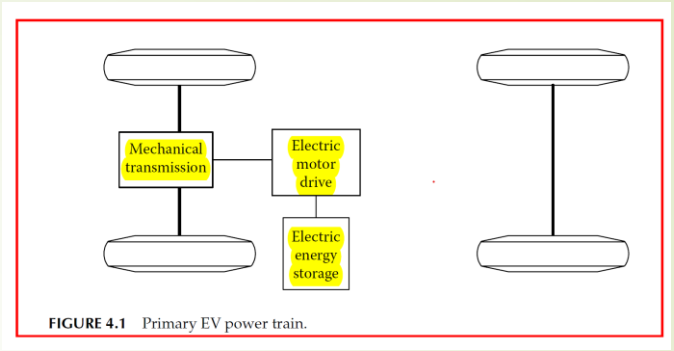


FIGURE 4.1 Primary EV power train.

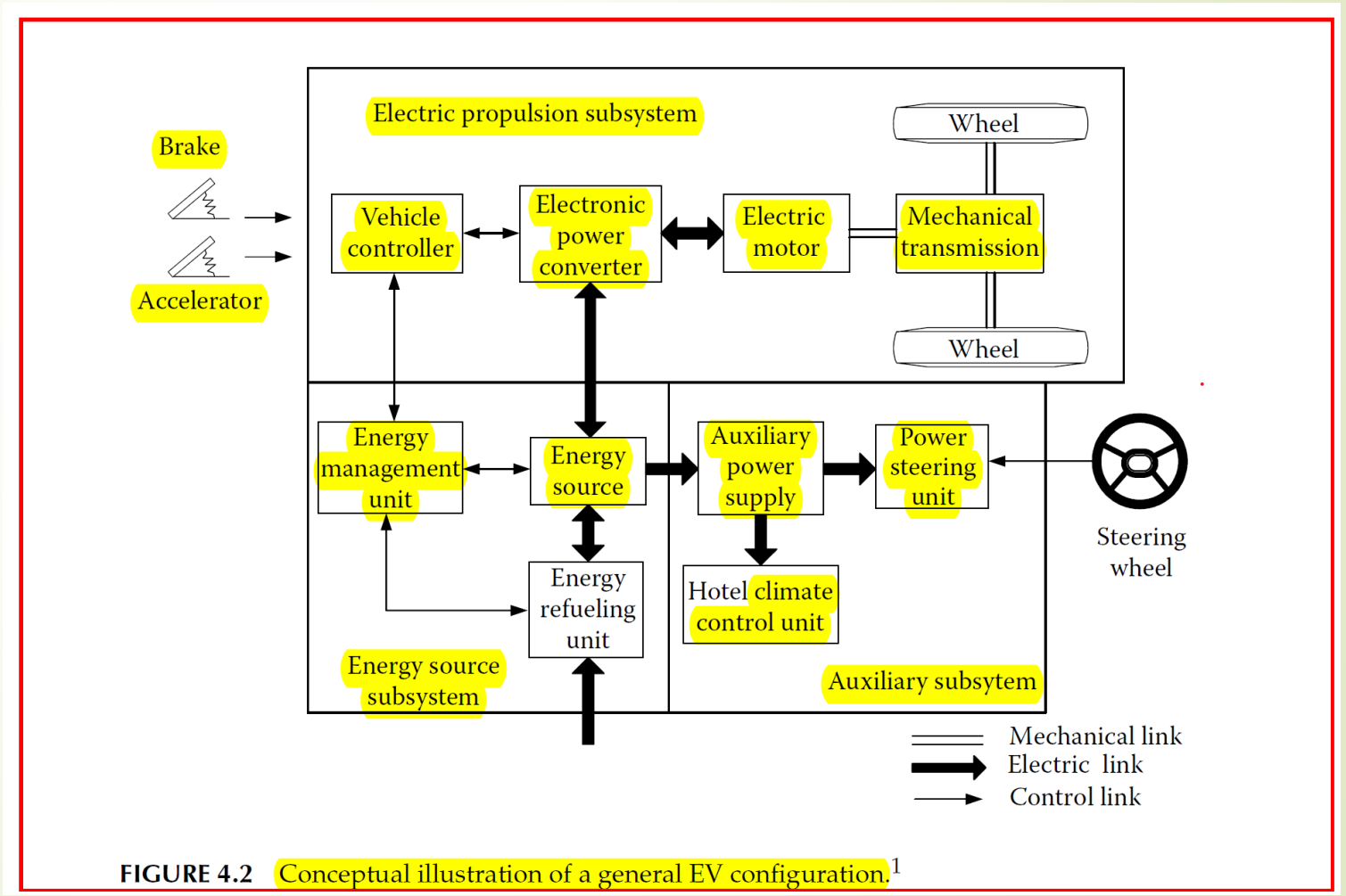
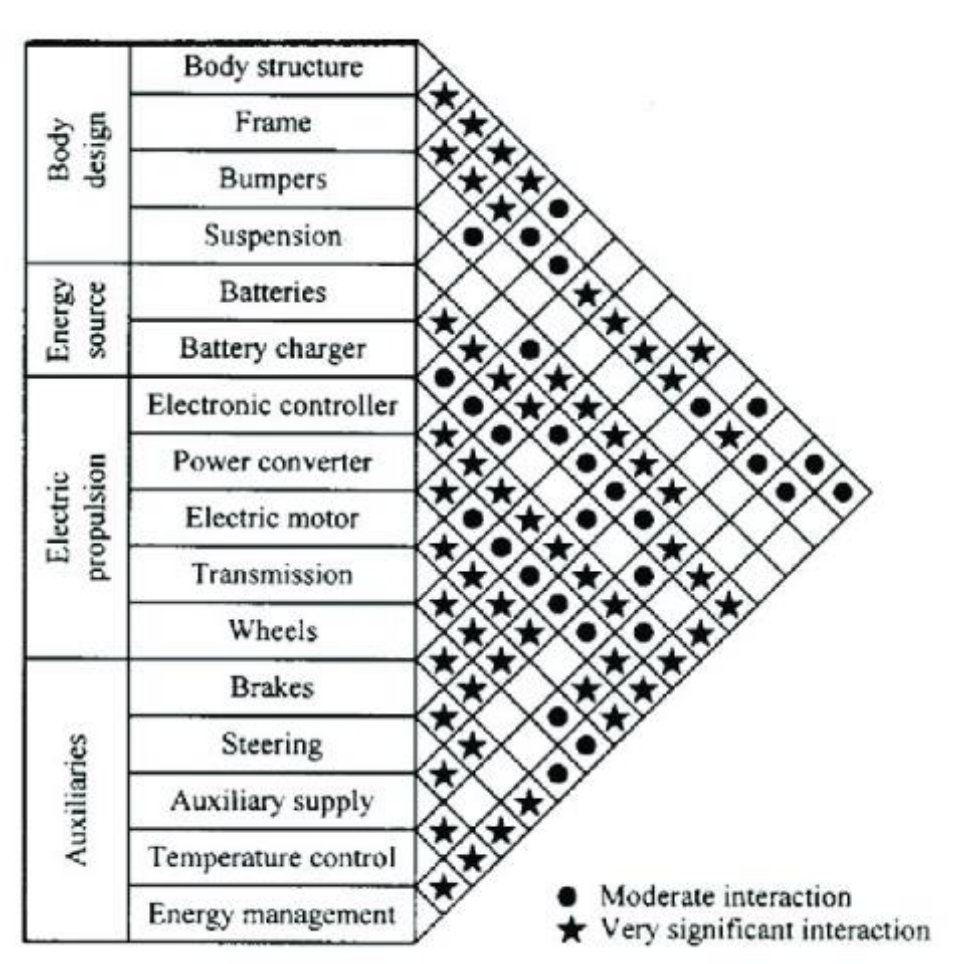


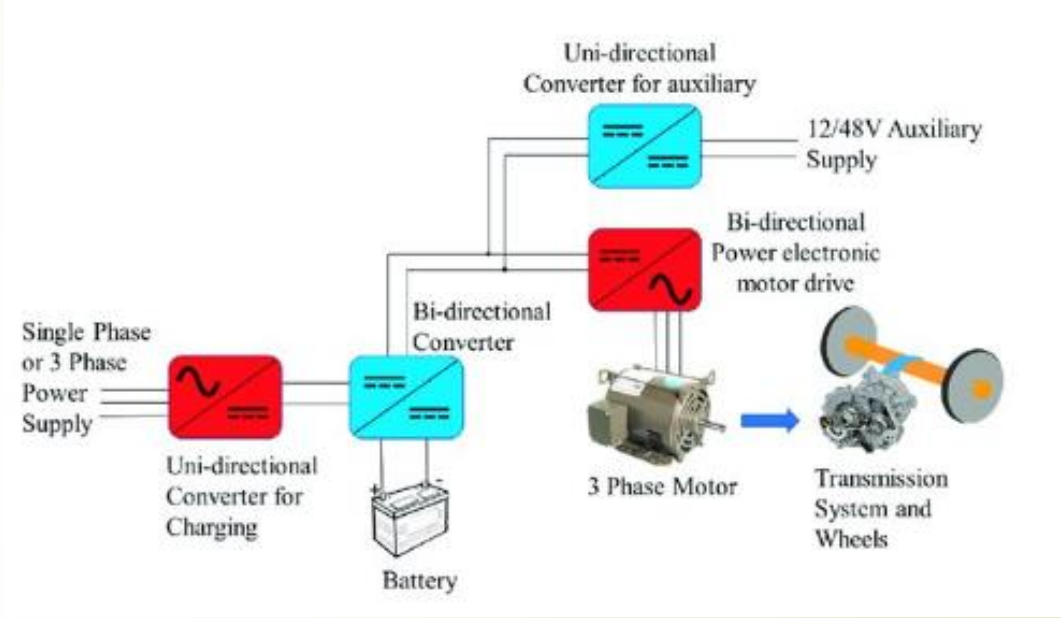
FIGURE 4.2 Conceptual illustration of a general EV configuration.[1]

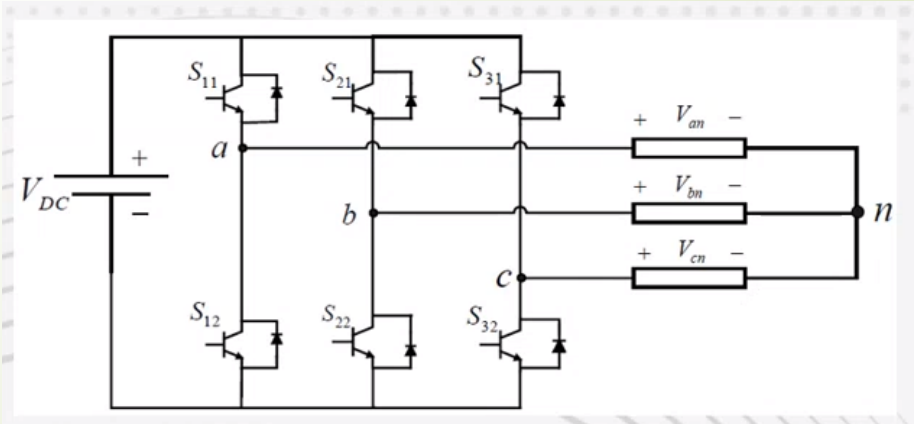
BEV

Different subsystems and their interaction with electric vehicles



Power electronics in electric vehicles





BEV

Evaluation of existing EV drives.

Factors	DC	Induction	SR	PMSM	PM BLDC
Power density	2	3	3.5	4.5	5
Efficiency	2	3	3.5	4.5	5
Controllability	5	4	3	4	4
Reliability	3	5	5	4	4
Maturity	5	5	4	5	4
Cost level	4	5	4	3	3
Noise level	3	5	2	5	5
Maintenance	1	5	5	5	5
Total	25	35	30	35	35

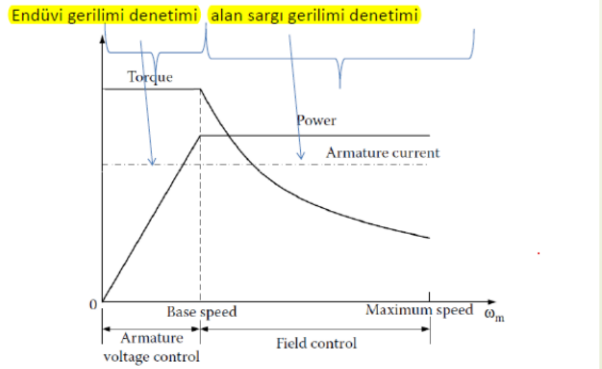
Elektrik Motoru

Motor seçiminin yapılmasının ardından sürüş profilinde yer alan performans isterleri, kalkış torku ve ivmelenme gibi parametrelere göre motorun faz gerilimi ve faz akımı değerleri belirlenir. Faz akımı ve gerilimi değerleri motor sürücü seçimi için en önemli parametrelerden birisidir.

Belirlenen güç değerlerine uygun olan motor sürücü seçenekleri arasında aşağıdaki kriterlere göre değerlendirmeler yapılır;

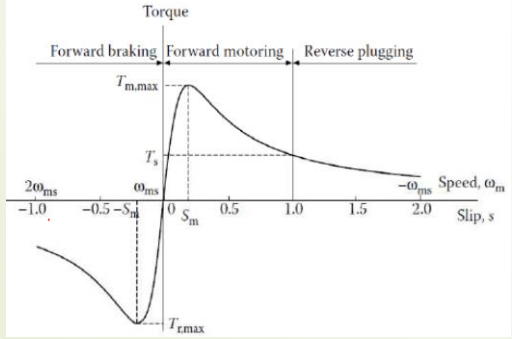
- Yüksek Güç Yoğunluğu (kW/kg, kW/L)
- Düşük Hacim
- Düşük Ağırlık
- Düşük Maliyet
- Yüksek Verim
- Düşük Harmonik
- Güvenilirlik (Koruma Özellikleri)

Sargılı DC Motor Denetimi

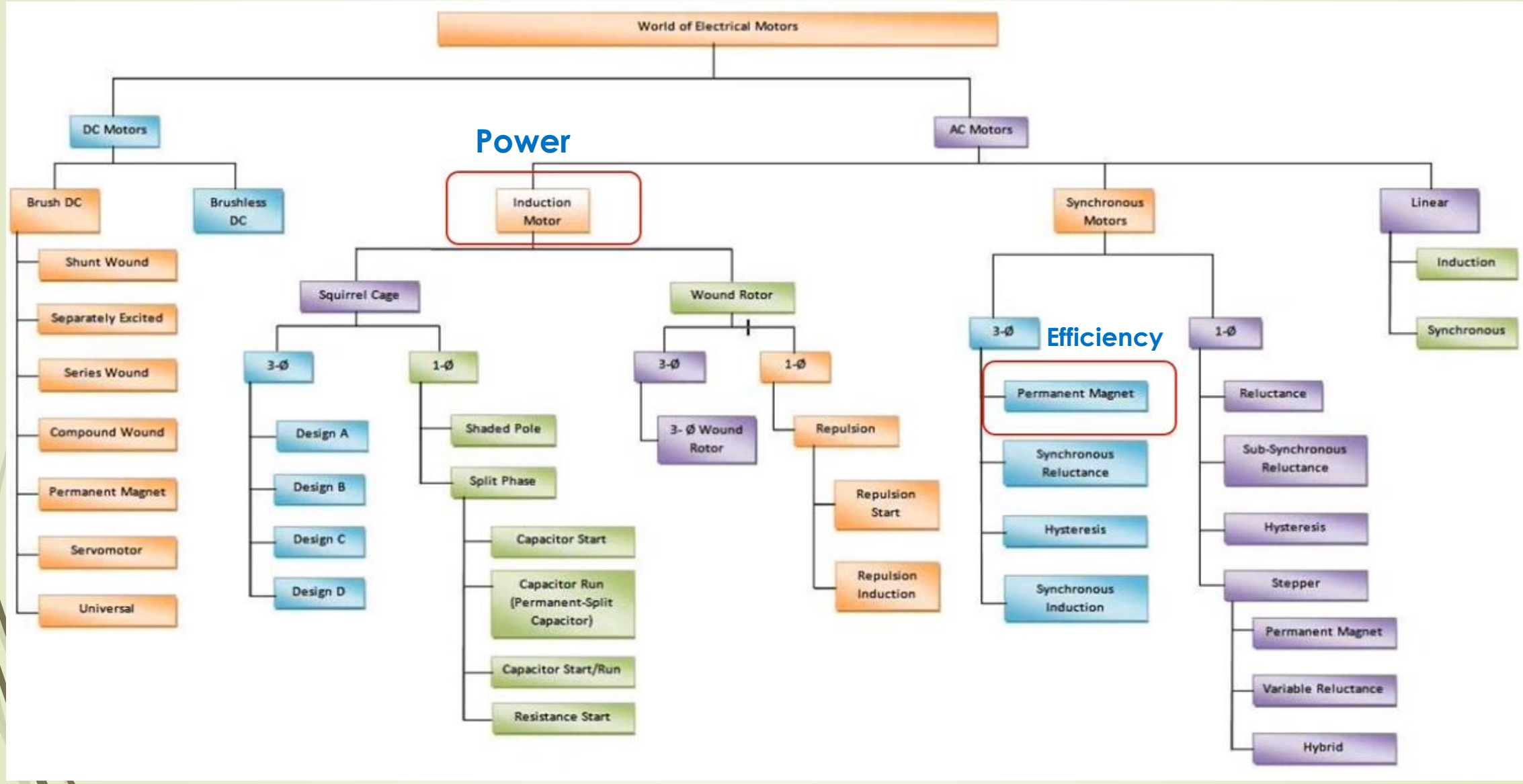


URE 6.7 Torque and power limitations in combined armature voltage and field control.

Asenkron Motor Hız-Moment Karakteristiği



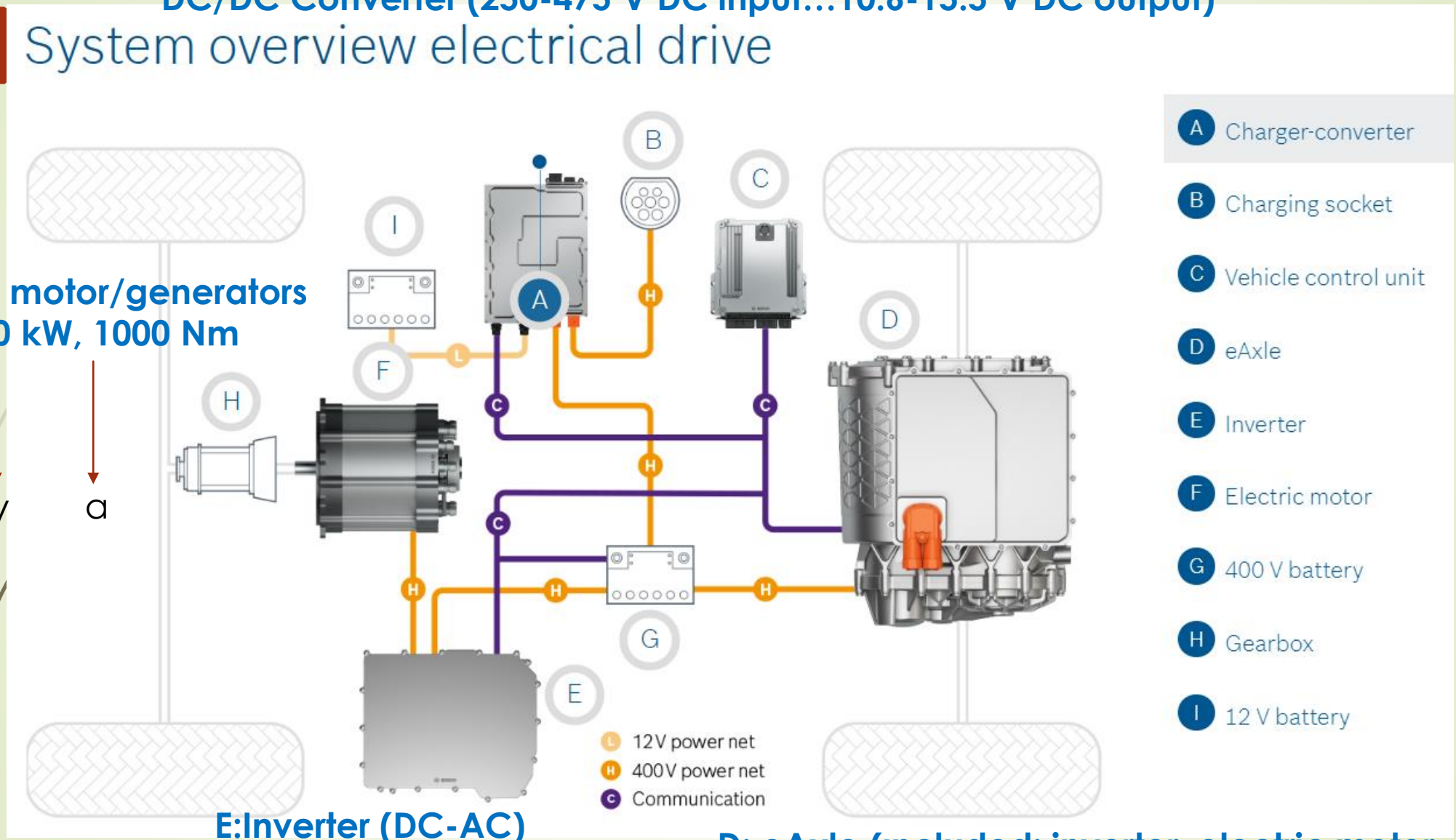
Drives Types	BEV Models
DC	Panda Elettra from FIat, Citroen berlingo Electrique, reva G-Wiz DC, three-wheeled tempos
SR	Chloride Lucas, converted General Motor prototype, small pick-up prototytpe
Induction	GM EV1, BMW Mini E, Tesla Roadster, Reva G-Wiz I, Mahindra Electric- E20 series, Verito, etc.
PMSM	Nissan leaf, Mitsubishi i-MiEV Focus Electric, Citroen C-Zero, Peugeot iOn ED BYD e6, Hyundai-Kona and Ioniq, KIA Soul EV and Niro, MG ZS EV, etc.


World of Electrical Motors
DC Motors
AC Motors
Power
Brush DC
Brushless DC
Induction Motor
Synchronous Motors
Linear
Shunt Wound
Separately Excited
Series Wound
Compound Wound
Permanent Magnet
Servomotor
Universal
Squirrel Cage
Wound Rotor
3-Ø
1-Ø
3-Ø
1-Ø
3-Ø
Efficiency
1-Ø
Induction
Synchronous
Design A
Design B
Design C
Design D
Shaded Pole
Split Phase
3- Ø Wound Rotor
Repulsion
Repulsion Start
Repulsion Induction
Permanent Magnet
Synchronous Reluctance
Hysteresis
Synchronous Induction
Reluctance
Sub-Synchronous Reluctance
Hysteresis
Stepper
Permanent Magnet
Variable Reluctance
Hybrid
Capacitor Start
Capacitor Run (Permanent-Split Capacitor)
Capacitor Start/Run
Resistance Start

BEV

A: On board Charger (AC)..7,2 kW (1ph) or 11 kW (3 ph) … DC-DC 50 kW or 100 kW
DC/DC Converter (250-475 V DC input…10.6-15.5 V DC output)

System overview electrical drive



F: Electric motor/generators
850 V, 500 kW, 1000 Nm

t V a

E:Inverter (DC-AC)
50-450 kW, 840 V, 210-900 A

D: eAxle (ıncluded; inverter, electric motor, gearbox)
840 V, 50-300 kW, 900 A

Şarj Teknolojisi

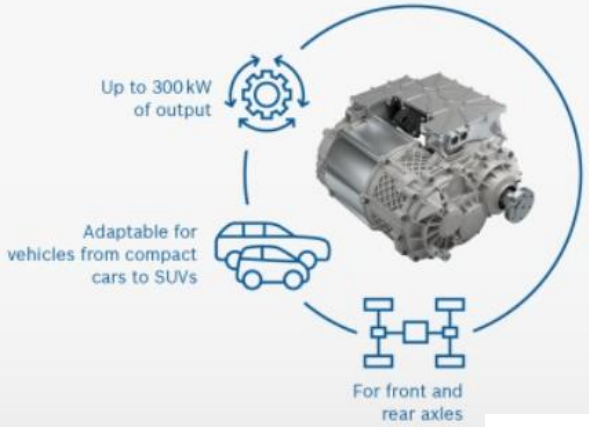
	Possible charging unit	Versions	Maximum charging power	Phases
	Charging cable	Basic (standard)	2.7 kW	1-phase
	Wallbox	OE 4U8 rapid charging with AC	7.4 kW	1-phase
	Wallbox	OE 4U6 rapid charging with AC, multi-phase	22 kW Wallbox 11 kW vehicle	3-phase
	DC charger	OE 4U7 rapid charging with DC	50 kW	3-phase

Acil Durum Bağlantısı (HV)

BEV and eAxle

Start up powertrain for electric vehicles

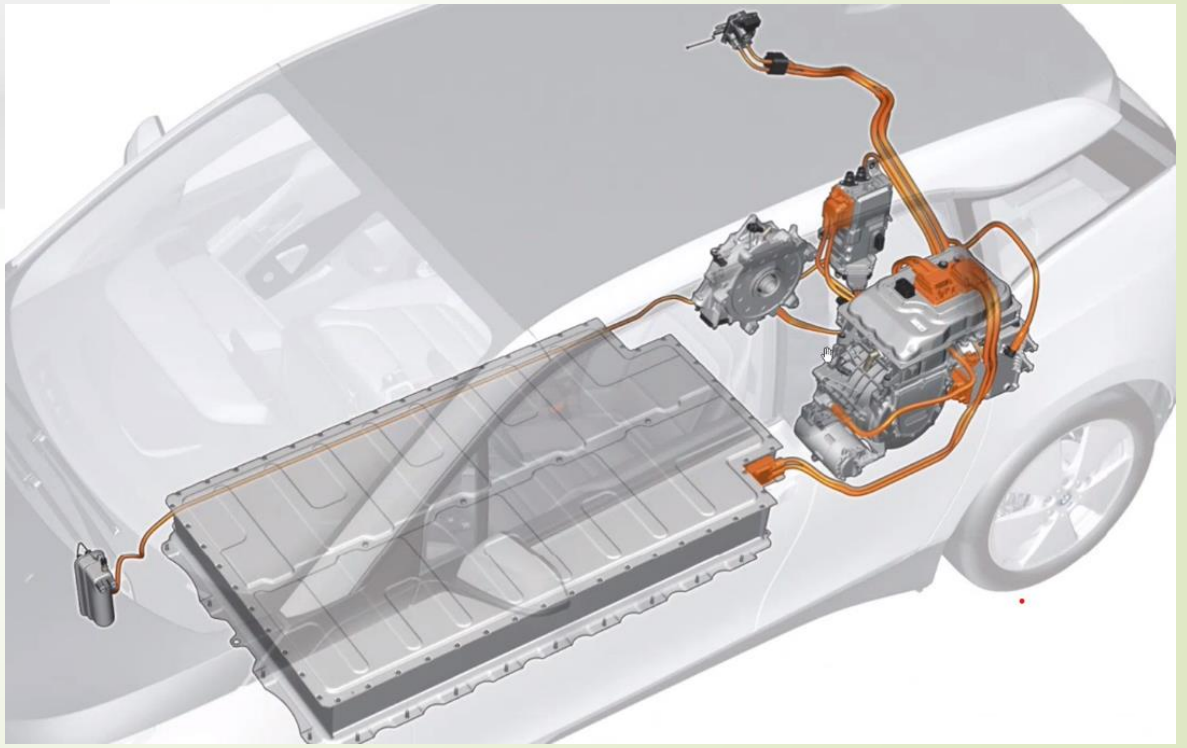
HIGH EFFICIENCY
The eAxle integrates the motor, electronics, and transmission in a compact way, increasing the efficiency of electric vehicles and hybrids.



Flexibly scalable up to

6,000 Nm

of torque at the driveshaft.



BEV Benefits

SYSTEM BENEFITS FOR MANUFACTURERS

- Energy-efficient and sustainable mobility solution
- Helps drivers comply with current and future legislation; zero CO_2 emissions
- High efficiency combined with direct storage and use of electrical energy means the lowest possible energy losses in operation
- Optimum cost–benefit ratio thanks to custom configuration based on a modular system for exploitation of economies of scale
- Intelligent system and software solutions for powertrain, thermal management as well as braking and steering systems for even more efficiency and safety

SYSTEM BENEFITS FOR DRIVERS

- New driving sensation: maximum torque delivered from a standing start for dynamic driving and a more relaxed daily routine thanks to low noise levels
- Free travel in all inner-city areas
- Low upkeep costs thanks to minimized maintenance effort and reduced complexity in the drive system
- Cost advantages thanks to regionally different subsidies

BEV Benefits

power vehicles purely electrically and are locally emission free

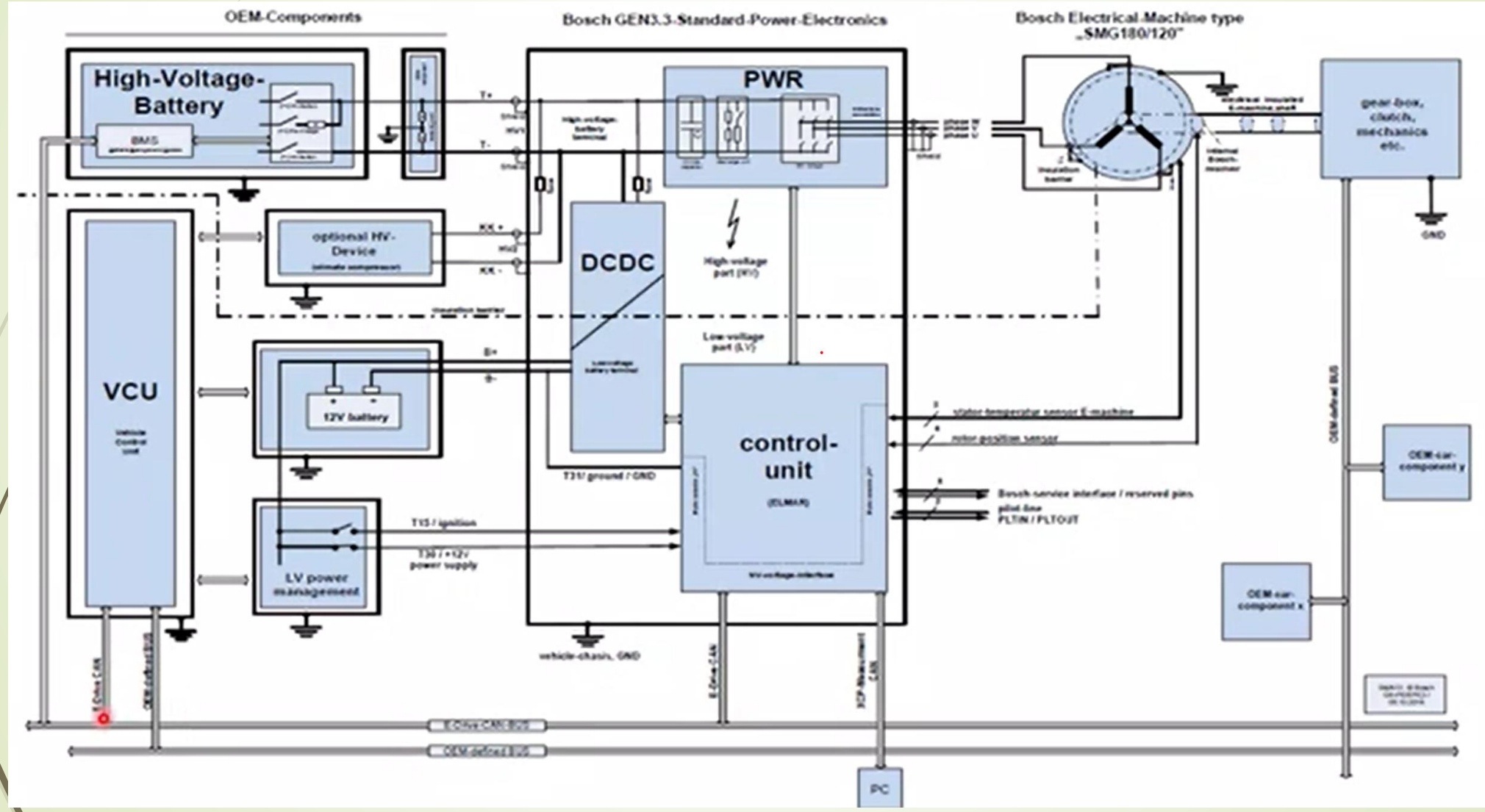
utilize energy in the most direct and efficient way with up to 96 % system efficiency

deliver full torque right from the start

are almost noiseless

reach ranges over 500 km thanks to improved technology (e.g. SiC)

BEV Electronics



BEV Electronics

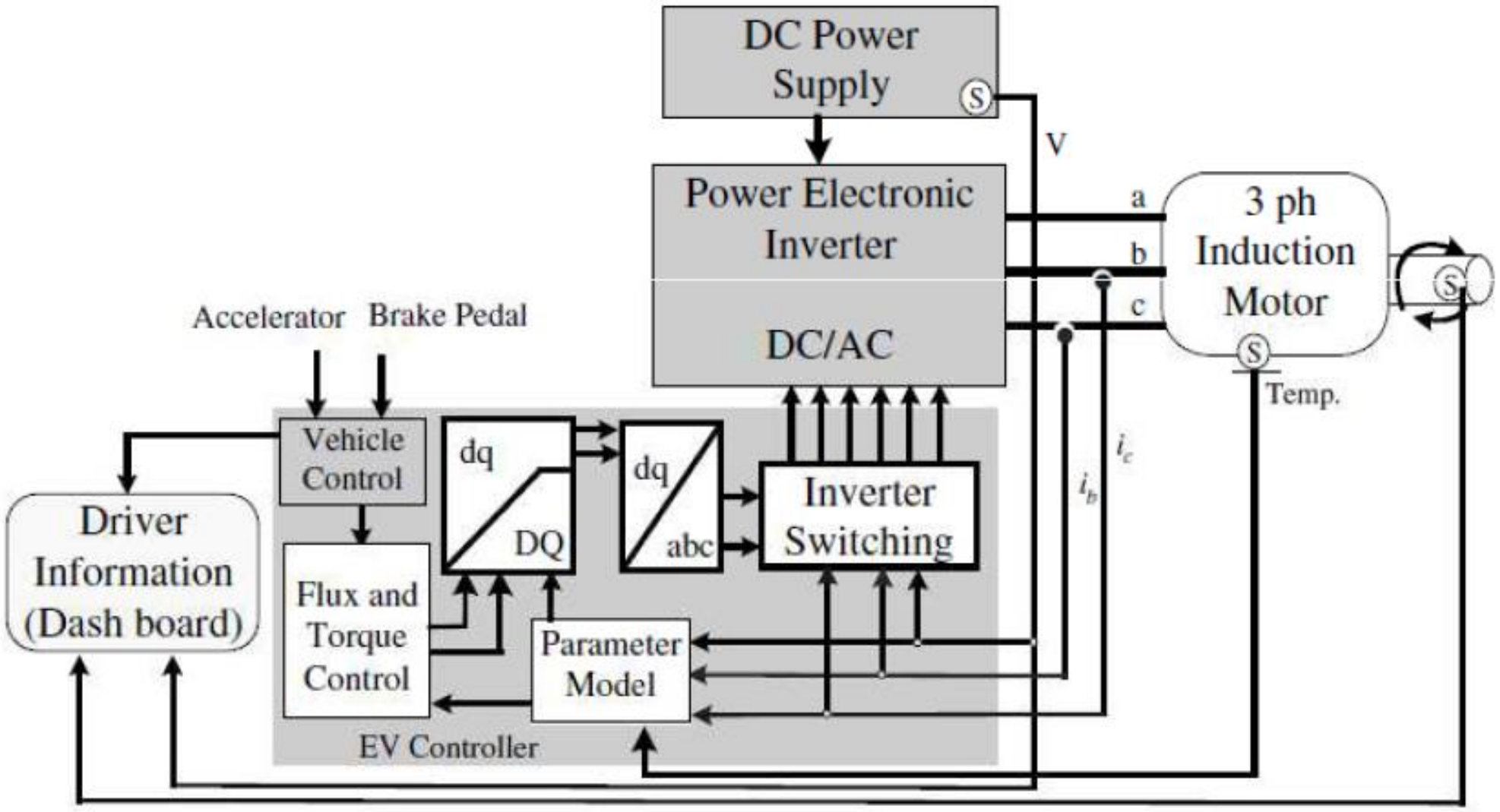


Figure 18.10 Main block diagram of EV induction motor DTC control.

BEV Araştırma Konuları

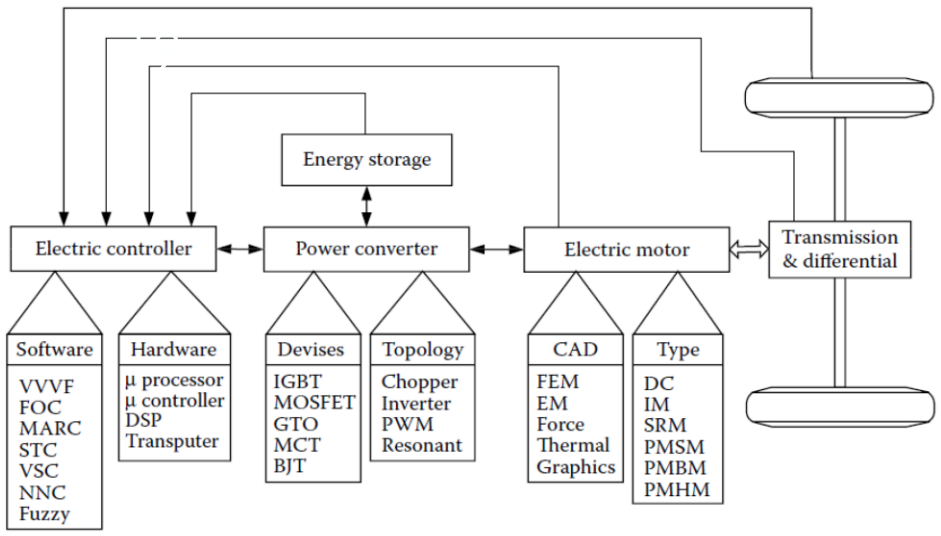


FIGURE 6.1 Functional block diagram of a typical electric propulsion system.[1]

- gate driver .....
- thermal management ...(sürücü ve motor)

Stratejik Karar	Seçenekler	Sınırlayan Faktörler
Elektrik Güç Seviyesi	İstenildiği kadar	E-Motor ve batarya teknolojileri ve maliyet
Elektrik Enerji Seviyesi	İstenildiği kadar	Batarya teknolojileri ve maliyet
Elektrik motor teknolojisi	***Sabit mıknatıslı senkron (verim) Asenkron (güç)***	Performans ve Maliyet
Motor Sürücü Topolojisi	Farklı Topolojiler, Güç Anahtarı Teknolojisi (SİC) Anahtarlama Frekansı (PWM, Half Brigde vs.)	Performans ve Maliyet
Batarya Teknolojisi	Li-Ion, vb..	Performans
Maliyet	Minimum	Ürünün Sunulduğu pazar

- electric motors ...
- Yüksek Moment Yoğunluklu Elektrik Motor Tasarımı
- Ucuz Mıknatıs ile Elektrik Motor Tasarımı
- Aynı paket içinde inverter motor tümleşik tasarımı (eAxle gibi)

.....

- BMS
- Taşıt dinamiği ve modelleme..

TEŞEKKÜRLER..