

Fact Sheet XXL

FIA Formula E Hong Kong

December 2/3, 2017

SCHAEFFLER

Rounds 1 & 2



[#HKEPrix](#)

Two races in the Asian metropolis Hong Kong kick off the 2017/2018 Formula E season



This is Formula E +++ Hong Kong +++ All races +++ Team +++ Drivers +++ Car +++ Technology +++ The energy chain +++ Electrified powertrain architectures from Schaeffler +++ History: Formula E and e-vehicles +++ Strategy: mobility for tomorrow +++ Facts and figures +++ Race track +++ Schedule +++ Contacts

Editorial

In Hong Kong, the innovative electric racing series will kick off its fourth season – with two races. Have you noticed how Formula E and electric mobility have been massively gaining importance around the globe? As pioneers in e-mobility we, from Schaeffler, have been on board and right in the middle of it since day

one. This season even with #1 displayed on Lucas di Grassi's car – which is still a thrilling sight. I wish our team, Audi Sport ABT Schaeffler, an equally great season as the most recent one and hope you will enjoy a literally electrifying experience of Formula E. In this brochure, we have summarized background info including facts and figures for you.



Jörg Walz
Vice President Communications and Marketing
Schaeffler Automotive

Contact

Schaeffler Technologies AG & Co. KG
Communications and Marketing
Schaeffler Automotive
Industriestr. 1–3, 91074 Herzogenaurach
presse@schaeffler.com, www.schaeffler.com

Motorsport of the future

With a bold concept that is unique in the world, Formula E has been fascinating fans, drivers and manufacturers

A visionary idea has turned into a hot and booming racing series: Welcome to Formula E. Its success formula? Fully electric racing on spectacular city street circuits in the world's largest metropolises, a tight event schedule – and all this with a commitment to environmental compatibility and sustainability. This concept has been well-received, not only by the fans but also by the participating

teams. More and more manufacturers and suppliers regard Formula E as a suitable platform for presenting their brand. Welcome to the future!

Involved from day one

Schaeffler recognized the potential of Formula E at an early stage and has been partnering with Audi Sport ABT Schaeffler since the inaugural season. In the 2017/2018 season, the team will be competing with Champion Lucas di Grassi, Daniel Abt and a new race car. The Audi e-tron FE04 is running with powertrain technology "made by Schaeffler."



#HKEPrix



Hong Kong–Herzogenaurach



9,040 km

More than seven million people packed in a very tight space – yet Hong Kong is a worldwide role model in terms of mobility

Hong Kong and its population

Some 260 islands make up the Hong Kong Special Administrative Region in South Asia. The built-up area – accounting for only about 25 percent of the total – due to steep slopes and mountain ranges, frequently consists of man-made terrain. More than seven million people live in this small space. With **27,000 residents per square kilometer**, Hong Kong is the most densely populated state, even before the principality of Monaco. Due to the world's highest life expectancy and an annual immigration rate of eight people per 1,000 residents, the population keeps growing.

Mobility

Like any big city, Hong Kong groans under a high urban traffic volume. Yet the density of cars – at **72 vehicles per 1,000 inhabitants** – is relatively low. For comparison: In Western Europe and the United States, it is about 500 cars. Only about eight percent of Hong Kong's population use bicycles and privately owned vehicles.

Present and future

Hong Kong counteracts the threat of total gridlock with a perfectly developed, advanced public transportation system. Buses and taxis are powered by liquid gas, subway stations can be found every five minutes of walking distance and the world's largest, 800 meter long outdoor escalator system carries people up and down the steep hills. Some 14,000 of the small number of privately owned cars – equating to **2.6 percent of all registered vehicles** – are fully electric, which is a very high rate. Owners of electric cars enjoy tax breaks. Hong Kong's vision: to be the world's most sustainable metropolis.

7,347,000

inhabitants

1,104 km² of area



Contrasts A typical Chinese junk in front of Hong Kong's modern skyline

Hong Kong
in December

20 °C
Daytime temperature

15 °C
Nighttime temperature

6
Hours of sunshine/day

3
Days of rain/month

Around the *globe*

Africa, Asia, Europe, North and South America – Formula E stops on five continents on its world tour. With 14 races at eleven events the program is as extensive as never before

4

Santiago Chile

¡Bienvenidos!

February 3, 2018
Welcome to Formula E, Chile!
Spectacular: the race track in the capital city crosses a river.

6

São Paulo Brazil

Local hero

March 17, 2018
Home round for Champion Lucas di Grassi. It is planned to route the circuit across a section with grandstands for the carnival celebrations.

Paris France

Mobility in transformation

April 28, 2018
In 2015, the UN countries reached an accord here on improving environmental protection. With a wealth of ideas, Paris attempts to counteract daily gridlock.

8



Marrakesh Morocco

3

Goose bump moments

March 3, 2018
Fans experience a unique stadium atmosphere at Autódromo Hermanos Rodríguez.

Rome Italy

7

Back then ...

April 14, 2018
2,500 years after chariot races à la Ben Hur were held there in antiquity, Formula E makes its debut.

5

Mexico City Mexico



1 & 2

Hong Kong



Opener in the mega metropolis

December 2/3, 2017
Double-header. The technically challenging 1.86-kilometer circuit is located on the waterfront of famous Victoria Harbour.



Drivers' standings Top 10, 2016/2017

Pos.	Driver	Team	Points
1	Lucas di Grassi (BR)	ABT Schaeffler Audi Sport	181
2	Sébastien Buemi (CH)	Renault e.dams	157
3	Felix Rosenqvist (S)	Mahindra Racing	127
4	Sam Bird (GB)	DS Virgin Racing	122
5	Jean-Éric Vergne (F)	Techeetah	117
6	Nicolas Prost (F)	Renault e.dams	93
7	Nick Heidfeld (D)	Mahindra Racing	88
8	Daniel Abt (D)	ABT Schaeffler Audi Sport	67
9	José María López (RA)	DS Virgin Racing	65
10	Stéphane Sarrazin (F)	Techeetah	36

Teams' standings Top 3, 2016/2017

Pos.	Team	Points
1	Renault e.dams	268
2	ABT Schaeffler Audi Sport	248
3	Mahindra Racing	215

Berlin Germany

Schaeffler's home round

May 19, 2018
The race track, the former Tempelhof airport, is only about ten kilometers away from the government district in Berlin.



9

Premiere

June 10, 2018
Circuit races have been prohibited in Switzerland for more than 60 years – as a result of the 1955 tragedy at Le Mans. Formula E is the first series to have received a racing permit again.

Zürich Schweiz



10

New York USA

11 & 12

Big Apple

July 14/15, 2018
Formula E was the first ever single-seater series to bring motorsport directly into the heart of New York City. Last season, Lucas di Grassi started his comeback drive toward the title win in the U.S. metropolis.



Think green

July 28/29, 2018
Subsidies for electric vehicles and a well-developed network of bicycle paths – Montreal is a mobility role model in North America.

Montreal Canada

13 & 14



Teamwork

Technology partner Schaeffler, manufacturer and entrant Audi, fielding team ABT, drivers Lucas di Grassi and Daniel Abt and two Audi e-tron FE04 race cars – these are the protagonists making up Team Audi Sport ABT Schaeffler

Titles and victories
Schaeffler has celebrated triumphs in series such as:
Formula E, WEC,
24 H Le Mans, DTM,
24 H Nürburgring,
Dakar Rally and
endurance rallies

SCHAEFFLER

Innovative technology group +++ Motorsport as a platform for technology transfer between road and race track +++ Commitments in diverse racing series +++ Contributes know-how as an electric mobility pioneer to Formula E +++ Developed powertrain for Audi e-tron FE04



Formula E
1 x drivers' champion
DTM
5 x drivers' champion
4 x teams' champion
ADAC GT Masters
1 x drivers' champion
1 x teams' champion

ABT

Founded in 1896 as a smithy +++ Allgäu-based family business +++ Leading tuner for automobiles from the Volkswagen Group +++ Firmly established in motorsport since the 1990s +++ Formula E racing team since season one +++ Daniel Abt is CEO Hans-Jürgen Abt's son



Good luck Daniel Abt (left) and Georg F.W. Schaeffler, Supervisory Board Chairman

2009 1st ADAC Formel Masters
2012 2nd GP3 Series
2015 1st 24 Hours of Le Mans (in class)
2016 7th Formula E
2017 8th Formula E



Active in motorsport with factory-backed commitments since the 1980s +++ Successes in rally, sports car and touring car racing +++ In Formula E, initially gave its name to the team +++ In 2016/2017, partnership with Schaeffler and ABT intensified +++ Manufacturer and entrant from 2017/2018 season on

Formula E
1 x drivers' champion
WEC
2 x drivers' world champion
2 x manufacturers' world champion
13 x 24 H Le Mans winner
DTM/Super Touring Cars
10 x drivers' champion (DTM)
4 x manufacturers' champion (DTM)
12 x drivers' champion (STW)
8 x manufacturers' champion (STW)
Rally
2 x drivers' world champion
2 x manufacturers' world champion

The car's transformation into the new Audi e-tron FE04



Lucas di Grassi

Date of birth August 11, 1984
Place of birth São Paulo (BR)
Residence Monaco (MC)
Height 1.80 m
Weight 75 kg



2007 2nd GP2 Series, Formula 1 test driver
2014 2nd 24 Hours of Le Mans, 4th WEC
2015 3rd Formula E
2016 2nd Formula E
2017 1st Formula E



#1
Champion

Audi e-tron FE04

5,000 mm Length
1,790 mm Width
1,070 mm Height

880 kg weight including driver

200 kW output in qualifying
180 kW **NEW** output in race (2016/2017: 170 kW)

Powertrain **NEW**
Motor generator unit (MGU), 1-speed transmission

Bodywork
Specification spark-carbon body, specification front and rear wings

Battery
Available amount of energy: 28 kWh. Charging time: approx. 45 min.

Steering wheel
With shifting and recuperation paddles



Electrifying

Formula E proves that racing also works without the sound of engines and the smell of gasoline. A technology overview

The sound on the race track is a new one, and it's a sound of silence. Yet anyone who's ever been to a Formula E race knows that the human senses are stimulated – electrified – in every respect nonetheless. The high-tech race cars are on a par with their counterparts powered by IC engines and deliver highly thrilling motorsport where, in addition to pure speed, management of the energy from the battery with maximum efficiency plays a key role.

In terms of technological development, Formula E follows a technical roadmap. It includes specifications for teams and manufacturers designed to prevent a technological arms race. In the 2014/2015 inaugural season, identical electric race cars were used. Since season two, the teams have been able to develop the powertrain themselves. To the ABT Schaeffler FE01 and the FE02 – the race cars fielded in the 2015/2016 and 2016/2017 seasons – Schaeffler contributed

“Motorsport is emotion – and emotion is what we need in electric mobility as well”

Prof. Peter Gutzmer,
Deputy CEO and Chief Technology
Officer of Schaeffler AG

its know-how as a pioneer in electric mobility and as the team's official technology partner. In the new Audi e-tron FE04, technology “made by Schaeffler” operates as well. Schaeffler engineers together with Audi again developed the combination of the motor and transmission including the control electronics.

The spectacle intensifies

In the coming years, the technical roadmap provides for adjustments to make Formula E even more attractive. For the 2018/2019 season, for instance, the amount of energy available from the lithium-ion battery will increase from the current 28 to 54 kilowatt hours so that the vehicles will be able to cover a full race distance, eliminating the currently customary car change. The maximum power output will be raised from 200 to 250 kilowatts.

1

The new high-efficiency transmission of the Audi e-tron FE04 has one forward speed

Interview



On the hunt for hundredths
Dr. Simon Opel (34) is Director Special
Projects Motorsports at Schaeffler

3 questions for ...

... Dr. Simon Opel

What thoughts come to your mind when looking back on three seasons that have culminated in the Formula E Champion's crown?

That it was a very exciting period, from the very first second when we created the concept for the powertrain together with ABT. It was a continuous learning process of how to find the best compromise between performance and energy efficiency.

What is the technical and emotional motivation for season four?

As engineers, we're always striving to come up with the best possible technical solution. However, in terms of time and money, that's not always feasible. However, in collaboration with Audi and their resources, we've significantly enhanced our powertrain yet again. In Formula E, details and hundredths matter with respect to the components and the setup. Plus, our motivation is obviously unbroken, with victories and titles continuing to be the name of the game ...

As a Schaeffler engineer, what is your assessment of the electric mobility megatrend?

For me, electric mobility is a technology that has to be communicated to people via emotions. This is the only way to show that electric mobility can be fun as well. Motorsport and Formula E are perfectly suited for this. And as engineers, we learn a lot from developments for Formula E. Still, I don't believe that electric mobility is the cure-all for everyone. The various questions about mobility require answers that best meet the respective need, in other words: what type of powertrain is truly suitable for what purpose?

Schaeffler know-how for energy chain and powertrain architectures

Sustainable mobility begins with renewable production of primary energy and includes the entire energy chain, culminating in diverse and smart solutions for locomotion. Schaeffler develops innovative solutions for a wide variety of powertrains



Energy production

Sustainable mobility can only be successfully achieved if the primary energy for locomotion is produced from renewable sources as well, for instance by wind and hydropower, solar or geothermal energy. Schaeffler develops powerful components for wind farms and hydropower stations and supports their operators with services such as remote diagnosis. Together with its partners, Schaeffler also conducts research into new approaches to developing renewable sources, for instance with wave and tidal power stations for predictable supply of economically produced electricity.



Energy storage and conversion

Before electrical energy can drive a wheel it has to be placed into intermediate storage. There are various possibilities to do so, starting with the charging current for batteries. In the field of hydrogen/fuel cells, Schaeffler engineers are conducting research into surface coatings for efficiency improvements. In addition, renewable electricity can be used to produce synthetic fuels for internal combustion engines which, under specific circumstances, can be near-CO₂ neutral across the entire energy chain.



Energy utilization

Also with respect to utilizing energy for the powertrain, there are diverse solutions for which Schaeffler develops a wide range of special technologies. In addition to optimizing the internal combustion engine and mated transmission, Schaeffler engineers are working on solutions for the electrification of the powertrain, optimal interaction of the IC engine and the electric motor for hybrid vehicles and tailor-made electric powertrains (battery-electric and fuel cell systems).



Electrified powertrain architectures

Fully electric and hybrid electric vehicles will be playing an important part in mobility of the future. From high-voltage hybrid modules to electric axles through to visionary wheel-hub drive systems, Schaeffler offers an extensive and innovative product portfolio. Also in focus of the globally active technology group are solutions for the "last mile." They include the Bio-Hybrid that shows an all-new approach to urban micro-mobility and E-Boards that can be stowed and carried along without requiring a lot of space.

- 1 Hybrid module
- 2 Wheel hub drive in the People Mover
- 3 E-Axle
- 4 Bio-Hybrid
- 5 E-Board



The *SUCCESS* story

Involved from day one and now the reigning champion – a brief look at Schaeffler's first three seasons in Formula E

2014/2015

Cooperation signed and sealed

At the time of Formula E's debut, Schaeffler and ABT Sportsline with drivers Lucas di Grassi and Daniel Abt are **the only German team**. The season starts sensationally: Di Grassi wins the inaugural race in Beijing. After five additional podiums, the Brazilian finishes third overall, Abt eleventh overall.



2015/2016

Schaeffler inside

Schaeffler contributes the **know-how for the powertrain** of the race car, the ABT Schaeffler FE01. In terms of racing, Team ABT Schaeffler Audi Sport continues to run on the highest level. Following three wins, Lucas di Grassi finishes the season in position two overall with a deficit of only two points. Daniel Abt, on finishing runner-up in front of his home crowd in Berlin, achieves his best result to date and ends the season in seventh place overall.

More than a century of electric vehicles



1899 La Jamais Contente

Electric vehicles dominate the early days

There are more e-cars on the road than cars with IC engines and Porsche manufactures e-powertrains for Lohner. First car traveling at more than 100 km/h: "La Jamais Contente".



1972 Mercedes-Benz E-Transporter

Club of Rome: "The Limits to Growth"

IC engines come under pressure, plus an oil crisis emerges. Industry responds with premature e-powertrains. Batteries are too heavy and deliver insufficient range.



1996 General Motors EV1

Range: 250 km; 0.19 cd

The EV1 is a purpose-designed electric vehicle. The next quantum leap: Sony invents the lithium-ion battery with which Tesla stirs up the auto industry in 2008.



1997 Toyota Prius

Hybrid with electric motor and IC engine

Prius becomes a million-seller. E-drive works with hydrogen and oxygen even without a traction battery: Mercedes in 2003 showcases the world's first fuel cell passenger car.



2014 FIA Formula E

Motorsport with e-drive

July 2009: McLaren-Mercedes wins with hybrid drive for the first time in Formula 1. In September 2014, Formula E debuts – as the first electrically powered racing series.

2016/2017

Champion!

Formula E has long become established as a **staple in motorsport**. At the top of the standings, a well-known duel begins to unfold. Halfway through the season, Sébastien Buemi seems to be the sure champion. Then Lucas di Grassi embarks on a comeback drive which he crowns with the title win at the finale in Montreal.



Mobility for tomorrow

For Schaeffler, innovation has been part of its corporate DNA ever since the company was founded. Lateral and interdisciplinary thinking is part of the program

Schaeffler is known as an innovation leader delivering a wealth of technologies that make automobiles more fuel-efficient, environmentally friendly and safer. Additionally, the company offers products for trains, aircraft, wind turbines and many other industrial sectors. Schaeffler can be found wherever things are in motion. And motion means mobility as well. The challenges facing mobility of the future are immense. That's why Schaeffler is committed to its holistic "Mobility for tomorrow" strategy concept geared to finding sustainable solutions for the world of tomorrow.

"Progressive climate change, increasing urbanization and globalization, as well as digitalization will have a substantial impact on our lives and work. This particularly applies to the field of mobility"

Klaus Rosenfeld,
Chief Executive Officer Schaeffler



Compact info



Lucas di Grassi #1

- lucasdigrassi.com.br
- lucasdigrassiofficial
- @LucasdiGrassi
- lucasdigrassi
- LucasDiGrassi



Daniel Abt #66

- danielabt.de
- abtdaniel
- @Daniel_Abt
- daniel_abt
- AbtDaniel

Audi e-tron FE04

- Aerodynamics**
Adjustable front and rear wings
- Electric motor**
Audi Schaeffler MGU02
- Battery**
Lithium-ion battery from Williams (34 kWh, 28 kWh of which is usable)
- Transmission**
High-efficiency 1-speed racing transmission
- Brakes**
Hydraulic dual-circuit braking system, adjustable brake force distribution, plus braking effect due to recuperation via e-drive
- Suspension**
Independent front and rear
- Weight**
880 kg minimum (including driver)
- Dimensions**
Length 5,000 mm, width 1,790 mm, height 1,070 mm

The Audi e-tron FE04 accelerates from 0 to 100 km/h in

3.5 seconds

200 kW output in qualifying

180 kW output in race

3 drivers with the largest number of #FanBoost votes have 100 kJ more energy

1 #FanBoost in second car

fanboost.fiaformulae.com



Schaeffler facts

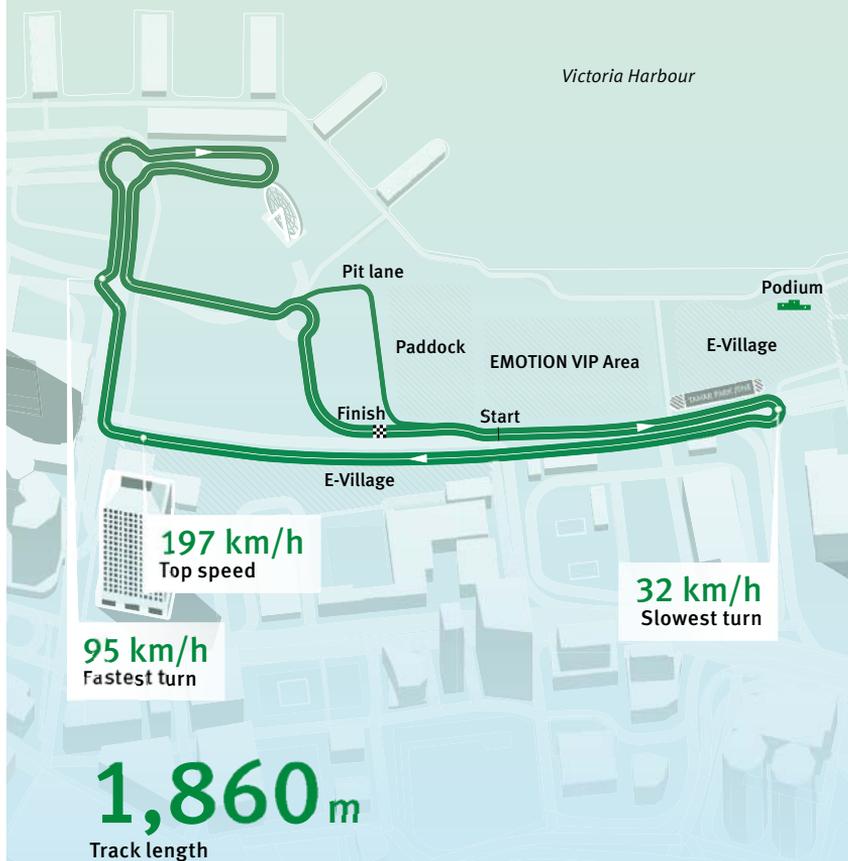
- ≈ 87,000 employees worldwide
- 13.3 bn euros of sales in 2016
- > 2,300 patent applications filed in 2016
- 25,000 active patents and patent applications
- 170 locations in 50 countries
- 75 plants worldwide
- 60 Schaeffler components in automobiles worldwide (average)
- 17 research and development centers worldwide

Schaeffler in Formula E

- 1** drivers' title
- 33** races
- 3** fastest race laps
- 4** #1 pole positions
- 6** victories
- 28** #FanBoost
- 24** podium positions

The *race track*

Hong Kong Central Harbourfront Circuit



Schaeffler

- schaefflergroup
- @schaefflergroup
- schaeffler.com
- Schaeffler

Audi Sport

- AudiSport
- @audiformulae
- audi.com/audisport
- audisport
- audisportsnaps

Team ABT

- abtmotorsport
- @abtmotorsport
- abt-sportsline.de
- ABTSportslineTV
- abtmotorsport

FIA Formula E

- fiaformulae
- @FIAFormulaE
- fiaformulae.com
- FIAFormulaE
- fiaformulae



Learn more about mobility for tomorrow



Video Racing for a reason

December 2, 2017

- 07:00 – 07:45 Free practice 1
- 09:30 – 10:00 Free practice 2
- 11:00 – 11:36 Qualifying (4 groups)
- 11:45 – 12:00 Super Pole
- 13:00 – 13:30 Autograph session (E-Village)
- 14:00 Driver parade
- 14:23 Pit lane open
- 15:04 Race (43 laps)
- 16:05 Podium
- 16:25 – 16:40 Press conference (Media Center)

December 3, 2017

- 08:30 – 09:15 Free practice 3
- 11:00 – 11:36 Qualifying (4 groups)
- 11:45 – 12:00 Super Pole
- 13:00 – 13:30 Autograph session (E-Village)
- 14:00 Driver parade
- 14:23 Pit lane open
- 15:04 Race (45 laps)
- 16:05 Podium
- 16:25 – 16:40 Press conference (Media Center)