# Fact Sheet XXL

SCHAEFFLER

## FIA Formula E Marrakesh

January 13, 2018

Round 3


#MarrakeshEPrix

Team Audi Sport ABT Schaeffler starts the new Formula E year of 2018 with a race in North Africa

This is Formula E +++ Marrakesh +++ 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

***Welcome to the new year and to the second event of the 2017/2018 Formula E season.*** *Following two electrifying races at the Hong Kong opener, our Team Audi Sport ABT Schaeffler will now be battling for points and trophies in Marrakesh. I think it's remarkable that Formula E is again visiting the African continent. Electric mobility has by now become present around the globe. We at Schaeffler are pioneers in electric mobility and have been on board and right in the middle since day one. I hope you will enjoy an exciting Formula E race. In this brochure, we have summarized information, facts and figures for you.*

Jörg Walz
Vice President Communications and Marketing
Schaeffler Automotive

# Contact

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# 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 is 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."


# #MarrakeshEPrix

Marrakesh–Herzogenaurach 2,540 km

**Near one of the largest solar parks – and horse carriages in the historic part of the city. Modernity and tradition form a unit in Marrakesh**

## Country and people

Marrakesh is located in the west of Morocco, 50 kilometers north of Toubkal, North Africa's highest peak. With an area of 230 square kilometers the "Red City" is about the same size as Frankfurt am Main. The population density of 4,500 people per square kilometer (total population: 1.036 million) equates to that of Munich.

## A city of contrasts

In terms of mobility, Marrakesh has many facets: the pristine central station featuring a traditional oriental architectural style here and horse carriages that serve as both a practical means of transportation and tourist attraction primarily in the historic center of Medina there. Morocco in general is a country that is ushering in the future, the "Noor 1" solar park 200 kilometers southeast of Marrakesh that was opened in 2016 being a case in point. It generates electricity for 350,000 people, which makes it one of the world's largest facilities of its kind. Other "Noor" parks are either under construction or in planning.

## An environmental message

Last season, the Marrakesh E-Prix was launched as an official partner event of the concurrent 22nd UN Climate Conference "COP22." This political meeting took place on the basis of the ground-breaking Paris Climate Conference the year before and continued to set the course for a greener future. The Formula E race served as the official sporting opening event. "Formula E is fully aware of the challenges and risks entailed by climate change," says Formula E promoter Alejandro Agag. "Having been part of the most important climate forum was a great honor."

**1,036,000**
*inhabitants*

**230 km²** *of area*

**Unique atmosphere** The historic center of Marrakesh in front and the Atlas mountains in the background

**Marrakesh in January**

**18 °C** *Daytime temperature*

**6 °C** *Nighttime temperature*

**6** *Hours of sunshine/day*

**6** *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**


3

### *Breaking new ground*

***January 13, 2018***

*With the Marrakesh E-Prix last season Formula E gained a foothold on the African continent which emphasizes its global orientation.*

## *Drivers' standings*

| Pos. | Driver | Team | Points |
|---|---|---|---|
| 1 | Sam Bird (GB) | DS Virgin Racing | 35 |
| 2 | Jean-Éric Vergne (F) | Techeetah | 33 |
| 3 | Felix Rosenqvist (S) | Mahindra Racing | 29 |
| 4 | Edoardo Mortara (CH) | Venturi Formula E Team | 24 |
| 5 | Nick Heidfeld (D) | Mahindra Racing | 15 |
| 6 | Mitch Evans (NZ) | Panasonic Jaguar Racing | 15 |
| 7 | Nelson Piquet jr. (BR) | Panasonic Jaguar Racing | 12 |
| **8** | **Daniel Abt (D)** | **Audi Sport ABT Schaeffler** | **11** |
| 9 | António Félix da Costa (P) | Andretti Formula E | 8 |
| 10 | Oliver Turvey (GB) | NIO Formula E Team | 8 |
| **17** | **Lucas di Grassi (BR)** | **Audi Sport ABT Schaeffler** | **0** |

## *Teams' standings*

| Pos. | Team | Points |
|---|---|---|
| 1 | Mahindra Racing | 44 |
| 2 | DS Virgin Racing | 41 |
| 3 | Techeetah | 33 |
| **6** | **Audi Sport ABT Schaeffler** | **11** |


1 & 2

### *Misfortune at season opener*

***December 2/3, 2017***

*After coming fifth on Saturday, Daniel Abt as the winner of race two is excluded due to an administrative error. Lucas di Grassi remains without points.*

4


### *¡Bienvenidos!*

***February 3, 2018***

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


5

### *Goose bump moments*

***March 3, 2018***

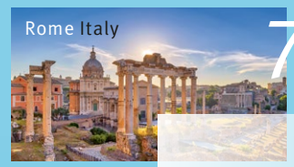
*Fans experience a unique stadium atmosphere at Autódromo Hermanos Rodríguez.*


6

### *Welcome back*

***March 17, 2018***

*The round at the Uruguayan seaside resort replaces the event in São Paulo. Punta del Este was previously part of the calendar in the first two Formula E seasons.*

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### *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.*


8

### *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.*


9

### *Schaeffler's home round*

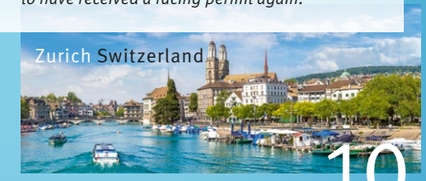
***May 19, 2018***

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

### *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.*

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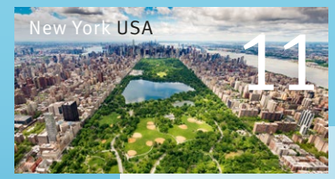



11 & 12

### *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.*


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

*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*

*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 24H 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

## #66 Daniel Abt

***Date of birth*** *December 3, 1992*
***Place of birth*** *Kempten (D)*
***Residence*** *Kempten (D)*
***Height*** *1.79 m*
***Weight*** *72 kg*

| | |
|---|---|
| 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 |

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

**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*



#1 Champion

| | |
|---|---|
| 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 |

## Audi e-tron FE04

880 kg ***weight*** *including driver*

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

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 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.

**"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

## 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**


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

## 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-$CO_2$ 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.*

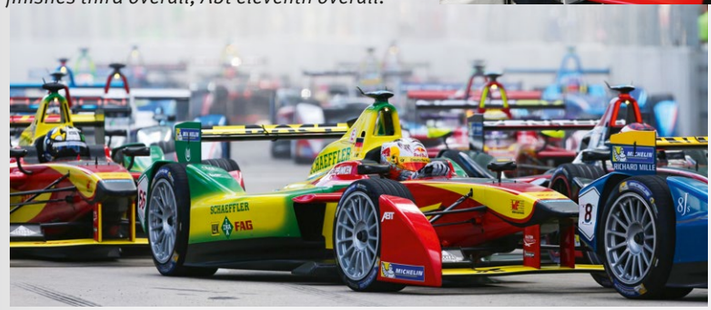
# The *success* story

**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*

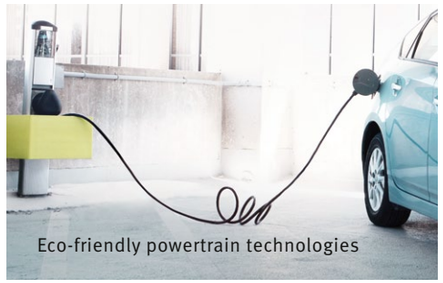
**For Schaeffler, innovation has been part of its corporate DNA ever since the company was founded. Lateral and interdisciplinary thinking is part of the program**

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


Energy chain


Eco-friendly powertrain technologies


Urban mobility


Interurban mobility

# 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***

FAN BOOST

*fanboost.fiaformulae.com*

## Schaeffler facts

**89,400** *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*

**35** *races*

**4** *fastest race laps*

**4** *pole positions*

**6** *victories*

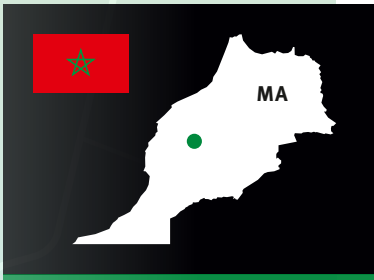
**30** *#FanBoost*

**24** *podium positions*

# The *race track*

## Circuit International Automobile Moulay El Hassan

SCHAEFFLER





**2,971 m**
Track length

1 Finish
2 Start
3 Pit lane
4 Media Center
5 EMOTION VIP Area
Podium

### Schaeffler
- schaefflergroup
- @schaefflergroup
- schaeffler.com
- SchaefflerGlobal

### 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

SATURDAY

### January 13, 2018

| | | | |
|---|---|---|---|
| 08:00 – 08:45 | Free practice 1 | 15:00 | Driver parade |
| 10:30 – 11:00 | Free practice 2 | 15:23 | Pit lane open |
| 12:00 – 12:36 | Qualifying (4 groups) | 16:04 | Race (33 laps) |
| | | 17:05 | Podium |
| 12:45 – 13:00 | Super Pole | 17:25 – 17:40 | Press conference (Media Center) |
| 14:00 – 14:30 | Autograph session (E-Village) | | |

**Learn more** about mobility for tomorrow

**Video** Racing for a reason