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Solar PV Engineering and Installation Preparation for the NABCEP PV Installation Professional Certification Routledge

Drawing on the Asian Development Bank's experience installing the rooftop solar photovoltaic system at its headquarters, the Handbook for Rooftop Solar Development in Asia hopes to demystify the process of developing solar photovoltaic projects in urban areas. The handbook provides detailed descriptions and guidance for all stages of development, including initial prefeasibility assessment, design, financing, procurement, and operations and maintenance. The Asian Development Bank hopes that entities looking to take advantage of the benefits of solar photovoltaic systems would find the development process made transparent and streamlined, and that this handbook would encourage the spread of solar photovoltaic systems in cities throughout developing Asia and the Pacific.

Small wind turbines utilize wind energy to produce power with rated capacities of 100 kilowatts or less. With this increasingly popular technology, individual businesses, farms, and homes can generate their own electricity and cut their energy bills , while generating power in an environmentally sound manner. The challenges facing the engineers who are tasked with planning and developing these small wind systems are multifaceted, from choosing the best site and accurately estimating power output, to obtaining proper permitting and troubleshooting operational inefficiencies. Optimization of project development for small wind applications is a necessity. Small Wind: Planning and Building Successful Installations provides a cohesive guide to achieving successful small wind installations from an informed expert. It is a

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comprehensive information resource from one of the world's most experienced small wind professionals, covering all the key issues for small wind system development, from site and machine selection to international standards compliance. Establishes technical guidelines for the growing number of engineers called upon to plan small wind projects Identifies and explains the critical issues for small wind installations, including siting, turbine choice, applications and permitting, economics, load management, and grid integration Examples from real projects demonstrate key considerations for success, complete with template spreadsheets and measurements needed to support project planning efforts Includes reports on the most commonly used turbines and designs and synthesizes and clarifies relevant wind industry documentation, saving readers endless hours of research

A comprehensive training resource for producing electric power from the sun.

Photovoltaic Systems is a comprehensive guide to the design and installation of several types of residential and commercial PV systems. Numerous illustrations explain the concepts behind how PV arrays and other components operate, and photographs of actual installations show how components are integrated together to form complete systems. This textbook addresses the PV topics included in the NABCEP Entry Level Program. This new edition also covers 2011 NECr requirements. A CD-ROM is also included with Photovoltaic Systems and contains information to supplement the textbook.

Whether or not you are taking the NABCEP Entry Level Exam, learning the material covered in this book is the best investment you can make towards your place in the solar industry. This book explains the science of photovoltaics (PV) in a way that most people can understand using the curriculum which reflects the core modules of the NABCEP Entry Level Exam.

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Providing complete coverage of the NABCEP syllabus in easily accessible chapters, addressing all of the core objectives that will aid in passing the PV Entry Level Exam including the ten main skill sets: PV Markets and Applications Safety Basics Electricity Basics Solar Energy Fundamentals PV Module Fundamentals System Components PV System Sizing Principles PV System Electrical Design PV System Mechanical Design Performance Analysis, Maintenance and Troubleshooting You will learn the importance of and how to survey a site, how to use the tools that determine shading and annual production, and the importance of safety on site. With technical math and equations that are suitable and understandable to those without engineering degrees, but are necessary in understanding the principles of solar PV. This study guide is written by Sean White an IREC certified Solar PV Master Trainer, Electrician, Professor and Installer. Sean has prepared thousands of students to take the NABCEP Solar PV Entry Level Exam.

The market and policy impetus to install increasingly utility-scale solar systems, or solar farms (sometimes known as solar parks or ranches), has seen products and applications develop ahead of the collective industry knowledge and experience. Recently however, the market has matured and investment opportunities for utility-scale solar farms or parks as part of renewable energy policies have made the sector more attractive. This book brings together the latest technical, practical and financial information available to provide an essential guide to solar farms, from design and planning to installation and maintenance. The book builds on the challenges and lessons learned from existing solar farms, that have been developed across the world, including in Europe, the USA, Australia, China and India. Topics covered include system design, system layout, international installation standards, operation and maintenance,

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grid penetration, planning applications, and skills required for installation, operation and maintenance. Highly illustrated in full colour, the book provides an essential practical guide for all industry professionals involved in or contemplating utility-scale, grid-connected solar systems.

Urban Energy Transition, second edition, is the definitive science and practice-based compendium of energy transformations in the global urban system. This volume is a timely and rich resource for all, as citizens, companies and their communities, from remote villages to megacities and metropolitan regions, rapidly move away from fossil fuel and nuclear power, to renewable energy as civic infrastructure investment, source of revenue and prosperity, and existential resilience strategy. Covers technical, financial, systems, urban planning and design, landscape, mapping and modelling, and sociological issues related to urban renewable energy transformations Presents city-wide renewable energy strategies and urban thermal performance planning, sector coupling, and smart distributed renewable energy and storage systems Examines individual and mass transport systems in the contexts of urban mobility trends and energy innovations Explains successful innovations in solar bond finance, blockchain technology enabled peer-to-peer renewable energy trading systems, and the case for renewable energy based regional monetary systems Features foci on

societal, community and user enabling aspects such as energy justice, prosperity and democracy, and urban renewable energy legislation, programs and incentives Includes analytic case insights into successful practices from around the globe that provide local, regional and country-specific governance and organizational perspectives

Energy Storage Basics closely covers the basics of energy storage in the form of a study guide. It is meant for energy professionals and a technical audience interested in understanding the concepts of electricity, renewables, and energystorage solutions. The important concepts will be covered and defined, and readers will have a chance to test themselves at the end of each chapter. The last decade has shown incredible progress in the world's transition towards a clean energy future. Today, the most competitive levelized costs of electricity, which refers to the cost of generating electricity and operating a power plant, is large scale grid-connected solar photovoltaics systems. As the world transitions towards clean energy, new challenges will emerge that need to be addressed. Renewable energy such as solar and wind energy are intermittent and non-continuous, which makes its output unpredictable and consequently makes managing energy loads a challenge. As intermittent renewable energy contributes to an ever larger proportion of our energy consumption, energy storage will play

an important role in managing loads within the electricity grid. More specifically, energy storage will provide grid operators and utilities with the flexibility to deploy energy in response to their needs. Also, energy storage will allow residential and commercial industrial consumers to generate their own electricity and operate outside of the electric grid - what we often call 'behind the meter'. Energy storage systems, also referred to in this book as ESS, we believe is the holy grail for this clean energy transition.

NABCEP sets the standard for solar certifications in the United States and Canada. The NABCEP PV Technical Sales Certification shows customers, friends and employers that you are knowledgeable and qualified to sell solar systems. If someone is selling solar, they need to know what they are selling and how it is configured. Where will they connect the circuit breaker? Will the house need expensive modifications in order for a PV system to be installed? These are the questions that you as a NABCEP Technical Sales Certified solar salesperson will confidently answer. This book is full of practical information that anyone selling solar should know in order to properly serve their customers and to ethically represent the industry that is solving the world's problems on the ground and rooftop level. This book will be of use to those taking the NABCEP PV Technical Sales Exam, as well as anyone selling or planning to sell solar.

The NABCEP PV Installation Professional Exam is the gold standard certification exam for PV professionals and is famously difficult to pass. This book will provide test-taking strategy that can be used to most effectively study for and pass the exam. Code and theory is explained in the first half and will prove as useful background for the heart of the book which consists of practice exam questions and detailed explanations of the answers. It also contains essential strategy tools, short term memory tips and recommended reading which will be invaluable for anyone studying for the exam. The material in this book is not limited to those taking the exam as it will also be, more broadly, important for career progression and helping the reader to work safely with code compliant PV systems.

This book explains the science of photovoltaics (PV) in a way that most people can understand using the curriculum which reflects the core modules of the NABCEP Associate Exam. Whether or not you are taking the NABCEP Associate Exam, learning the material covered in this book is the best investment you can make insuring your place and moving up in the solar industry. Providing complete coverage of the NABCEP syllabus in easily accessible chapters, this book addresses all of the core objectives required to pass the exam, including the ten main skill sets: PV Markets and Applications Safety Basics Electricity Basics Solar Energy Fundamentals PV Module Fundamentals System Components PV

System Sizing Principles PV System Electrical Design PV System Mechanical Design Performance Analysis, Maintenance and Troubleshooting You will learn the importance of surveying a site and how to carry out a survey, how to use the tools that determine shading and annual production, and the necessity of safety on site. This guide also includes technical math and equations that are suitable and understandable to those without engineering degrees, but are necessary in understanding the principles of solar PV. This new edition of Sean White's highly successful study guide has been updated throughout and reflects recent changes in the industry.

Growth in photovoltaic (PV) manufacturing worldwide continues its upward trajectory. This bestselling guide has become the essential tool for installers, engineers and architects, detailing every subject necessary for successful project implementation, from the technical design to the legal and marketing issues of PV installation. Beginning with resource assessment and an outline of the core components, this guide comprehensively covers system design, economic analysis, installation, operation and maintenance of PV systems. The second edition has been fully updated to reflect the state of the art in technology and concepts, including: new chapters on marketing and the history of PV; new information on the photovoltaic market; new material on lightning protection; a

new section on building integrated systems; and new graphics, data and photos.

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Solar power, once a fringe effort limited to DIY enthusiasts, is now fast becoming mainstream. Many home and business owners are curious about solar electric and solar thermal systems, and wonder how to go about getting a clean energy generation system of their own. The vast majority will hire a professional installer to do the job. But what should they be asking of these installers? What system makes the most sense for their home or office: solar electric, solar hot water, solar heating, or some combination of these? A Solar Buyer's Guide for the Home and Office explains the options so that property owners can make the right choices both for their energy needs and their financial security. Understanding how solar power systems work will enable readers to be informed customers when dealing with professional installers-the book also provides advice on how to select a qualified installer and understand the expanding variety of tax credits and other incentives that are popping up around the country. The market for solar systems has been growing at an exponential rate and strong tax credits ensure continued growth even in a sluggish economy. Many of those who would like to catch this undeniable wave of the future are held back by widespread confusion. A Solar Buyer's Guide for the Home and Office clears the air, allowing property

owners to move forward with confidence to make their homes and offices more comfortable, environmentally sound, and secure against wild swings in energy prices.

Even as concern over climate change and energy security fuel a boom in solar technology, many still think of solar as a twentieth-century wonder. Few realize that the first photovoltaic array appeared on a New York City rooftop in 1884, or that brilliant engineers in France were using solar power in the 1860s to run steam engines, or that in 1901 an ostrich farmer in Southern California used a single solar engine to irrigate three hundred acres of citrus trees. Fewer still know that Leonardo da Vinci planned to make his fortune by building half-mile-long mirrors to heat water, or that the Bronze Age Chinese used hand-sized solar-concentrating mirrors to light fires the way we use matches and lighters today. With thirteen new chapters, *Let It Shine* is a fully revised and expanded edition of *A Golden Thread*, Perlin's classic history of solar technology, detailing the past forty years of technological developments driving today's solar renaissance. This unique and compelling compendium of humankind's solar ideas tells the fascinating story of how our predecessors throughout time, again and again, have applied the sun to better their lives — and how we can too.

Harnessing the wind can be a tricky business, but in this ground-breaking book the authors provide step-by-step, illustrated instructions for building a wind generator in a home workshop and then installing it in an off-grid home electrical system. Even if you don't plan on building your own turbine, this book is packed with valuable information for anyone considering wind energy. It covers the basic physics of how the energy in moving air is turned into electricity,

and most importantly, it will give you a realistic idea of what wind energy can do for you--and what it can't.

Welcome to the clean energy technicians field! If you are interested in a career as a clean energy technician, you've come to the right book. So what exactly do these people do on the job, day in and day out? What kinds of skills and educational background do you need to succeed in these fields? How much can you expect to make, and what are the pros and cons of these various fields? Is this even the right career path for you? How do you avoid burnout and deal with stress? This book can help you answer these questions and more. *Clean Energy Technicians: A Practical Career Guide* includes interviews with professionals in the following fields that have proven to be stable, lucrative, and growing professions: Wind Turbine Technician Solar Photovoltaic Installers Hydro Power Technicians Geothermal Technicians "The Open Access version of this book, available at <https://doi.org/10.4324/9780429458781>, has been made available under a Creative Commons Attribution-Non Commercial-No Derivatives 4.0 license." This book examines the uncertainties underlying various strategies for a low-carbon future. Most prominently, such strategies relate to transitions in the energy sector, on both the supply and the demand side. At the same time they interact with other sectors, such as industrial production, transport, and building, and ultimately require new behaviour patterns at household and individual levels. Currently, much research is available on the effectiveness of these strategies but, in order to successfully implement comprehensive transition pathways, it is crucial not only to understand the benefits but also the risks. Filling this gap, this volume provides an interdisciplinary, conceptual framework to assess risks and uncertainties associated with low-carbon policies and applies this consistently across 11

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country cases from around the world, illustrating alternative transition pathways in various contexts. The cases are presented as narratives, drawing on stakeholder-driven research efforts. They showcase diverse empirical evidence reflecting the complex challenges to and potential negative consequences of such pathways. Together, they enable the reader to draw valuable lessons on the risks and uncertainties associated with choosing the envisaged transition pathways, as well as ways to manage the implementation of these pathways and ultimately enable sustainable and lasting social and environmental effects. This book will be of great interest to students, scholars, and practitioners of environmental and energy policy, low-carbon transitions, renewable energy technologies, climate change action, and sustainability in general.

This exceptionally produced trainee guide features a highly illustrated design, technical hints and tips from industry experts, review questions and a whole lot more! Key content includes: Introduction to Solar Photovoltaics, Site Assessment, System Design, System Installation and Inspection, and Maintenance and Troubleshooting. Instructor Supplements Instructors: Product supplements may be ordered directly through OASIS at <http://oasis.pearson.com>. For more information contact your Pearson NCCER/Contren Sales Specialist at <http://nccer.pearsonconstructionbooks.com/store/sales.aspx>. Annotated Instructor's Guide (AIG) Paperback (Includes access code for Instructor Resource Center) 978-0-13-257117-3 TestGen Software and Test Questions - Available for download from www.nccercontrenirc.com. Access code comes in AIG and also available separately. Additional TestGen Software Access Code Cards 978-0-13-249316-1 PowerPoint Presentation Slides 978-0-13-257135-7

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Written with the installing electrician in mind, THE GUIDE TO PHOTOVOLTAIC SYSTEM INSTALLATION provides readers with a simple, straightforward approach to understanding photovoltaic system installation in both residential and light commercial buildings. Filled with illustrations, examples, and multiple opportunities for practice, this comprehensive book includes the most up-to-date information on photovoltaic installation available on the market today. In addition, coverage of topics such as the National Electrical Code® requirements for a photovoltaic system installation ensures that readers will be well prepared for the North American Board of Certified Energy Practitioners' (NABCEP) entry level photovoltaic installer certification exam. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

Solar thermal systems available today offer efficiency and reliability. They can be applied in different conditions to meet space- and water-heating requirements in the residential, commercial and industrial building sectors. The potential for this technology and the associated environmental benefits are significant. This book offers clear guidance on planning and installing a solar thermal system, crucial to the successful uptake of this technology. All major topics for successful project implementation are included. Beginning with resource assessment and an outline of core components, this guide details solar thermal system design, installation, operation and maintenance for single households, large systems, swimming pool heaters, solar air and solar cooling applications. Details on how to market solar thermal technologies, a review of relevant simulation tools and data on selected regional, national and international renewable energy programmes are also provided. In short, the book offers comprehensive guidance for professionals who wish to install solar thermal technology and will be a cherished

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resource for architects and engineers alike who are working on new projects, electricians, roofers and other installers, craftsmen undertaking vocational training and anyone with a specialized and practical interest in this field. Published with DGS

The ISEP meets the industry's need for a resource that contains the complete solar energy-related provisions from the 2018 International Codes and NFPA 70: 2017 NEC National Electrical Code, and selected standards in one document. The ISEP is organized such that it provides the best and most comprehensive tool for the design, installation and administration of both solar thermal (or solar heating and cooling) and photovoltaic systems. Similar to the organization of the International Energy Conservation Code (IECC), the Solar Commercial and Residential provisions have been presented in separate parts, to make it user friendly and easy to apply. Three important solar referenced standards have been included in their entirety: Solar Rating & Certification Corporation (SRCC) Standard 100 (Minimum Standards for Solar Thermal Collectors); SRCC Standard 300 (Minimum Standards for Solar Water Heating Systems); and SRCC Standard 600 (Minimum Standards for Solar Thermal Concentrating Collectors). Additional resources, such as sample solar permitting forms and links to the U.S. Department of Energy solar site access, have also been included, making this 2018 ISEP the single, most comprehensive document for solar energy code provisions and standards in the nation.

Used throughout the United States and many other countries, the National Electrical

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Code (NEC) is the world's most detailed set of electrical codes pertaining to photovoltaic (PV) systems. PV and the NEC presents a straightforward explanation of the NEC in everyday language. This new edition is based on the 2020 NEC, which will be used widely until 2026, with most of the interpretations and material staying true long after. This book interprets the distinct differences between previous versions of the NEC and the 2020 NEC and clarifies how these code changes relate specifically to PV installations. Written by two of the leading authorities and educators in the field, this book will be a vital resource for solar professionals, as well as anyone preparing for a solar certification exam.

The fun and easy way to get a grip on photovoltaic design and installation Designing and installing solar panel systems is a trend that continues to grow. With 'green collar' jobs on the rise and homeowners looking for earth-friendly ways to stretch their dollars and lesson their carbon imprint, understanding photovoltaic design and installation is on the rise. Photovoltaic Design & Installation For Dummies gives you a comprehensive overview of the history, physics, design, installation, and operation of home-scale solar-panel systems. You'll also get an introduction to the foundational mathematic and electrical concepts you need to understand and work with photovoltaic systems. Covers all aspects of home-scale solar-power systems Viable resource for professionals, students, and technical laymen Can be used to study for the NABCEP exam Whether you're a building professional looking to expand your business and skills to meet the

growing demand for solar power installation or are seeking a career in this rapidly expanding field, Photovoltaic Design & Installation For Dummies has you covered! This book focuses on the rapidly maturing solar photovoltaic (PV) industry, which is achieving an ever-increasing share of U.S. and global power production. There is a growing need for all stakeholders – owners, maintenance technicians, utilities, and installers – to fully understand the operations and maintenance of PV systems, and how to monitor and diagnose systems post installation. Recognizing this need, this book covers monitoring and diagnostic techniques and technologies, including how to identify the causes of poor performance, and measure and verify power production. Drawing on global case studies, it details how to achieve optimal PV power output in the field through an overview of basic electrical, the solar PV module and Balance of System, and processes and software for monitoring, measurement, and verification. It also provides an overview of the North American Board of Certified Energy Practitioner's (NABCEP) new PV System Inspector credential, which will be outlined in the final chapter. Equipping the reader with the knowledge and confidence required to maximize the output of solar PV installations, Solar Photovoltaics Power Optimization will be an essential resource for PV practitioners and students.

A Comprehensive Guide to Solar Energy Systems: With Special Focus on Photovoltaic Systems, the most advanced and research focused text on all aspects of solar energy engineering, is a must have edition on the present state of solar technology, integration

and worldwide distribution. In addition, the book provides a high-level assessment of the growth trends in photovoltaics and how investment, planning and economic infrastructure can support those innovations. Each chapter includes a research overview with a detailed analysis and new case studies that look at how recent research developments can be applied. Written by some of the most forward-thinking professionals, this book is an invaluable reference for engineers. Contains analysis of the latest high-level research and explores real world application potential in relation to developments Uses system international (SI) units and imperial units throughout to appeal to global engineers Offers measurable data written by a world expert in the field on the latest developments in this fast moving and vital subject

The primary purpose of PV Systems Engineering is to provide a comprehensive set of PV knowledge and understanding tools for the design, installation, commissioning, inspection, and operation of PV systems. During recent years in the United States, more PV capacity was installed than any other electrical generation source. In addition to practical system information, this new edition includes explanation of the basic physical principles upon which the technology is based and a consideration of the environmental and economic impact of the technology. The material covers all phases of PV systems from basic sunlight parameters to system commissioning and simulation, as well as economic and environmental impact of PV. With homework problems included in each chapter and numerous design examples of real systems, the book

provides the reader with consistent opportunities to apply the information to real-world scenarios.

The NABCEP PV Installation Professional (PVIP) Exam is the gold standard certification exam for PV professionals and is famously difficult to pass. As the industry grows and jobs have become more specialized, the Board has responded to this with NABCEP Specialist Certification Exams. As well as the content of the PVIP, this book also covers the material in the Design, Installer and Commissioning & Maintenance Specialist Certification Exams, and provides test-taking strategy that can be used to most effectively study for and pass these assessments. Code and theory is explained in the first half of this guide, acting as a useful background for the second half, which consists of practice exam questions and answers, complete with detailed explanations. It also contains essential strategy tools, short-term memory tips and recommended reading which will be invaluable for anyone studying for the exams. The material covered in this book is not limited to those taking the test, but will also act as a valuable tool for career progression, helping the reader to work safely with code-compliant PV systems. This second edition has been fully revised and updated to reflect the new developments in solar and energy storage systems and new technologies.

Solar Energy is an authoritative reference on the design of solar energy systems in building projects, with applications, operating principles, and simple tools for the construction, engineering, and design professional. The book simplifies the solar design and engineering

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process, providing sample documentation and special tools that provide all the information needed for the complete design of a solar energy system for buildings to enable mainstream MEP and design firms, and not just solar energy specialists, to meet the growing demand for solar energy systems in building projects.

Completion of the NABCEP entry-level exam ensures and reinforces that the professional has attained the basic knowledge of the fundamental concepts of PV system design, installation, and operation. The guide provides students with the information they will need to pass the exam.

This is the first and probably the only book devoted to utility-scale solar power – perhaps the fastest-growing sector of the global energy market. Philip Wolfe’s book describes the development and operation of large-scale solar power stations, and will interest all those who want to understand how these multi-million dollar projects are designed, structured, financed, constructed and maintained. It contains case studies of the Waldpolenz Energy Park, Germany, Lopburi Solar Plant in Thailand and the Topaz Solar Farm in California. Also included are interviews from leading figures in the PV industry. It shows the state of the world market and links to an online resource that continues to track the explosive growth of the sector. The book is arranged in three sections: A description of solar projects in context, and how they are undertaken. Chapters on developing and structuring projects; siting, consenting and connection issues; building and operating solar plants; design and technology basics; economies of solar photovoltaics. The second section reviews individual aspects of the project development and operational process in more detail. In particular it advises on strategies to manage technology, commercial, regulatory and implementation risks. These are supported by

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a comprehensive reference section, including case studies and overviews of key parameters applicable in different parts of the world. Supported by figures and photographs, this book is for anyone wanting to master the commercial, professional, financial, engineering or political aspects of developing multi-mega-watt solar PV projects in a mainstream power market. It is a 'user manual' to accompany a sector which by 2015 had surpassed a value of \$100 billion. The greatest challenge of our time is to build a world based on the sustainable use of renewable power. Our massive dependence on fossil fuels has upset the very climatic system that made human evolution possible. The global economy and its financial system are in jeopardy, running hot on overtly cheap yet increasingly costly and fast depleting oil. A 100% renewable world is seen by many as an impossible dream in anything but the very long term. But not only do a growing number of initiatives and plans dare to make the change but many have already achieved it. This rich collection presents a series of pioneering efforts and their champions, and the paths to their successes. Ranging from initiatives by individuals to visions for companies, communities and entire countries, it defeats tired economic and technical counter-arguments, showing how the schemes featured not only can and do work but do so economically and with available technology. The book is introduced by incisive writing by Peter Droege, explaining the challenges and framing a roadmap towards a 100% renewable reality.

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